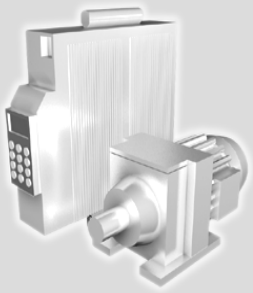
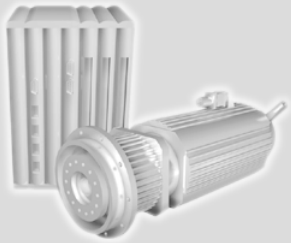
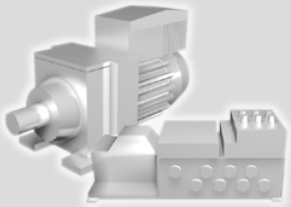
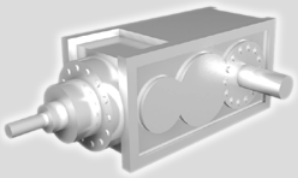
SEW EURODRIVE







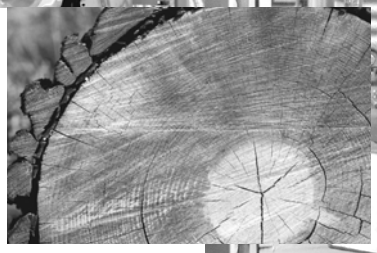


Fieldbus Interface DFE24B EtherCAT

Edition 05/2007

11571810 / EN

Manual



SEW EURODRIVE

1 Important Notes

1.1 Explanation of symbols

Always observe the safety and warning information in this documentation.

Electrical hazard
Possible consequences: Severe or fatal injuries.

Hazard.
Possible consequences: Severe or fatal injuries.

Hazardous situation.
Possible consequences: Slight or minor injuries.

Harmful situation.
Possible consequences: Damage to the unit and the environment.

Tips and useful information.

1.2 Integral part of the product

This manual is an integral part of the DFE24B EtherCAT fieldbus interface and contains important notes on operation and service.

1.3 Note on the documentation

- You must adhere to the documentation to ensure:
  - Fault-free operation
  - Fulfillment of any rights to claim under limited warranty
- Therefore, make sure you read this manual carefully before you install and startup frequency inverters with the DFE24B EtherCAT option card.
- This manual assumes that the user has access to and is familiar with the MOVIDRIVE® and MOVITRAC® documentation, in particular the MOVIDRIVE® MDX60B/61B and MOVITRAC® B system manuals.

1.4 Liability for defects

Incorrect handling or any action performed that is not specified in this manual could impair the properties of the product. In this case, you lose any right to claim under limited warranty against SEW-EURODRIVE GmbH & Co KG.

1.5 Product names and trademarks

The brands and product names in this manual are trademarks or registered trademarks of the titleholders.

1.6 Waste disposal

Please follow the current national regulations.

Dispose of the following materials separately in accordance with the country-specific regulations in force:

- Electronics scrap
- Plastics
- Sheet metal
- Copper

etc.

2 Safety Notes

Only install and startup the DFE24B EtherCAT fieldbus interface in accordance with the relevant accident prevention regulations and the MOVIDRIVE® MDX60B/61B and MOVITRAC® B operating instructions.

2.1 Preliminary information

The following safety notes refer to the use of the DFE24B EtherCAT fieldbus interface.

Please also observe the supplementary safety notes in the individual sections of this manual.

2.2 General safety notes

Never install damaged products or take them into operation.

Submit a complaint to the shipping company immediately in the event of damage.

2.2.1 General safety notes for bus systems

This communication system allows you to adjust the MOVIDRIVE® drive inverter to your specific application very accurately. **As with all bus systems, there is a danger of invisible, external (as far as the inverter is concerned) modifications to the parameters which give rise to changes in the inverter behavior. This may result in unexpected (not uncontrolled) system behavior.**

2.3 Transportation / putting into storage

Inspect the shipment for any damage that may have occurred in transit as soon as you receive the delivery. Inform the shipping company immediately. Do not operate the product if it is damaged.

Use suitable, sufficiently rated handling equipment if necessary.

Possible damage caused by incorrect storage!

Store the unit in a dry, dust-free room if it is not to be installed straight away.

2.4 Assembly / installation

Follow the instructions in section 4, "Assembly and Installation Notes."

2.5 Startup / operation

Follow the instructions in section 5, "Configuration and Startup."

3 Introduction

3.1 Content of this manual

This user manual describes how to:

- install the DFE24B EtherCAT option card in the MOVIDRIVE® MDX61B drive inverter
- use the DFE24B EtherCAT option card in the MOVITRAC® B frequency inverter and in the UOH11B gateway housing
- startup MOVIDRIVE® MDX61B on the EtherCAT fieldbus system
- startup MOVITRAC® B on the EtherCAT gateway
- configure the EtherCAT master using XML files
- operate MOVITOOLS® MotionStudio via EtherCAT.

3.2 Additional documentation

For information on how to connect MOVIDRIVE® simply and effectively to the EtherCAT fieldbus system, in addition to this user manual on the EtherCAT option, you should request the following documentation on fieldbus technology:

- "MOVIDRIVE® Fieldbus Unit Profile" manual
- MOVITRAC® B system manual

The "MOVIDRIVE® Fieldbus Unit Profile" manual and the MOVITRAC® B system manual describe the fieldbus parameters and their coding, and explains the whole range of control concepts and application options in the form of brief examples.

The "MOVIDRIVE® Fieldbus Unit Profile" manual contains a list of all drive inverter parameters that can be read or written via the various communication interfaces, such as system bus, RS485 and also via the fieldbus interface.

3.3 Features

The MOVIDRIVE® MDX61B drive inverter and the MOVITRAC® B frequency inverter enable you to use the DFE24B option to connect to higher-level automation systems via EtherCAT using its powerful, universal fieldbus interface.

3.3.1 MOVIDRIVE®, MOVITRAC® B and EtherCAT

The unit behavior of the inverter that forms the basis of EtherCAT operation is referred to as the unit profile. It is independent of any particular fieldbus and is therefore a uniform feature. This feature allows the user to develop drive applications independent of the fieldbus in operation. This makes it much easier to change to other bus systems, such as DeviceNet (option DFD).

3.3.2 Access to all information

MOVIDRIVE® MDX61B offers digital access to all drive parameters and functions via the EtherCAT interface. The drive inverter is controlled via fast, cyclic process data. You can use this process data channel to enter setpoints (e.g. setpoint speed, ramp generator time for acceleration/deceleration, etc.) and to trigger various drive functions such as enable, controller inhibit, normal stop, rapid stop, etc. At the same time you can use this channel to read back actual values from the drive inverter, such as the actual speed, current, unit status, fault number and reference signals.

3.3.3 Cyclic data exchange via EtherCAT

Process data is usually exchanged cyclically between the EtherCAT master and the MOVIDRIVE® B and MOVITRAC® B inverters. The cycle time is specified during the configuration of the EtherCAT master.

3.3.4 Acyclic data exchange via EtherCAT

The EtherCAT specification defines acyclical READ/WRITE services that are transferred together with the telegrams during ongoing cyclical bus operation without impacting on the performance of the process data communication via EtherCAT.

Read and write access to the drive parameters is enabled via SDO (Service Data Object) services that are implemented according to CoE (CANopen over EtherCAT) or VoE (Vendor-specific over EtherCAT) services.

This parameter data exchange enables you to implement applications in which all the important drive parameters are stored in the higher-level programmable controller, so that there is no need to make parameter settings manually on the drive inverter itself.

3.3.5 Configuration of the EtherCAT option card

The EtherCAT option card is designed so that all fieldbus-specific settings are made during startup of the EtherCAT system. This process enables the drive inverter to be integrated and operated in the EtherCAT environment within a very short period of time.

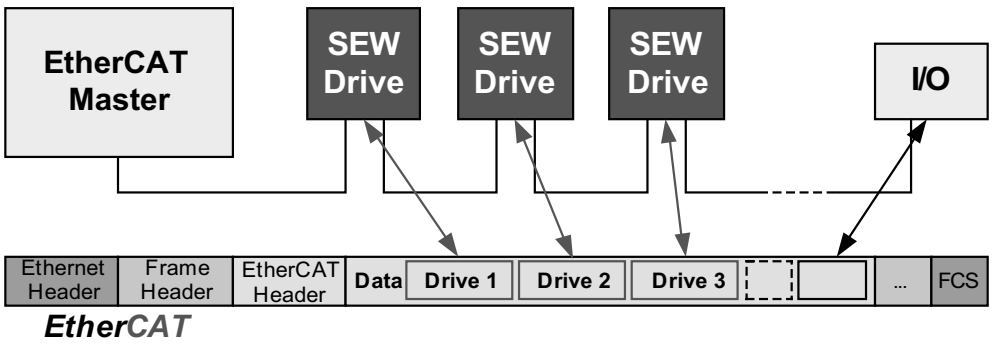


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Figure 1: EtherCAT with MOVIDRIVE®

3.3.6 Monitoring functions

Using a fieldbus system requires additional monitoring functions for the drive technology, for example, cycle time monitoring of the fieldbus (fieldbus timeout) or rapid stop concepts. You can, for example, adapt the monitoring functions of MOVIDRIVE® B / MOVITRAC® B specifically to your application. You can determine, for instance, which of the drive inverter's fault responses should be triggered in the event of a bus error. It is a good idea to use a rapid stop function for many applications. However you can also freeze the last setpoints so that the drive continues to operate with the most recently valid setpoints (for example, conveyor belt). As the functions of the control terminals are still active in fieldbus operation, you can still implement fieldbus-independent emergency stop concepts via the drive inverter terminals.

3.3.7 Diagnostics

The MOVIDRIVE® B drive inverter and MOVITRAC® B frequency inverter both offer a number of diagnostic options for startup and service. For example, you can use the integrated fieldbus monitor to control setpoint values sent from the higher-level controller and the actual values.

3.3.8 Fieldbus monitor

Furthermore, you are supplied with a variety of additional information about the status of the fieldbus option card. In conjunction with the MOVITOOLS® MotionStudio PC software, the fieldbus monitor function offers you an easy-to-use diagnostic tool for setting all drive parameters (including the fieldbus parameters) and for displaying the fieldbus and device status information in detail.

4 Assembly and Installation Notes

This section provides you with information on assembly and installation for the DFE24B option card in MOVIDRIVE® MDX61B, MOVITRAC® B and the UOH11B gateway housing.

4.1 Installing option card DFE24B in MOVIDRIVE® MDX61B

Only SEW-EURODRIVE personnel may install or remove option cards for MOVIDRIVE® MDX61B size 0.

- Users may only install and remove options cards for MOVIDRIVE® MDX61B sizes 1 to 6.
- The DFE24B option is powered with voltage via MOVIDRIVE® B. A separate voltage supply is not required.

4.1.1 Before you begin

The DFE24B option card must be installed in the fieldbus slot.

Read the following notes before installing or removing the option card:

- Disconnect the inverter from the power. Switch off the DC 24 V and the supply voltage.
- Take appropriate measures (discharge strap, conductive shoes, etc.) to protect the option card from electrostatic charge before touching it.
- Before **installing** the option card, remove the keypad and the front cover (→ MOVIDRIVE® MDX60B/61B operating instructions, Sec. "Installation").
- After **installing** the option card, replace the front cover and the keypad (→ MOVIDRIVE® MDX60B/61B operating instructions, Sec. "Installation").
- Keep the option card in its original packaging until immediately before you are ready to install it.
- Hold the option card by its edges only. Do not touch any subassemblies.

4.1.2 Basic procedure for installing and removing an option card

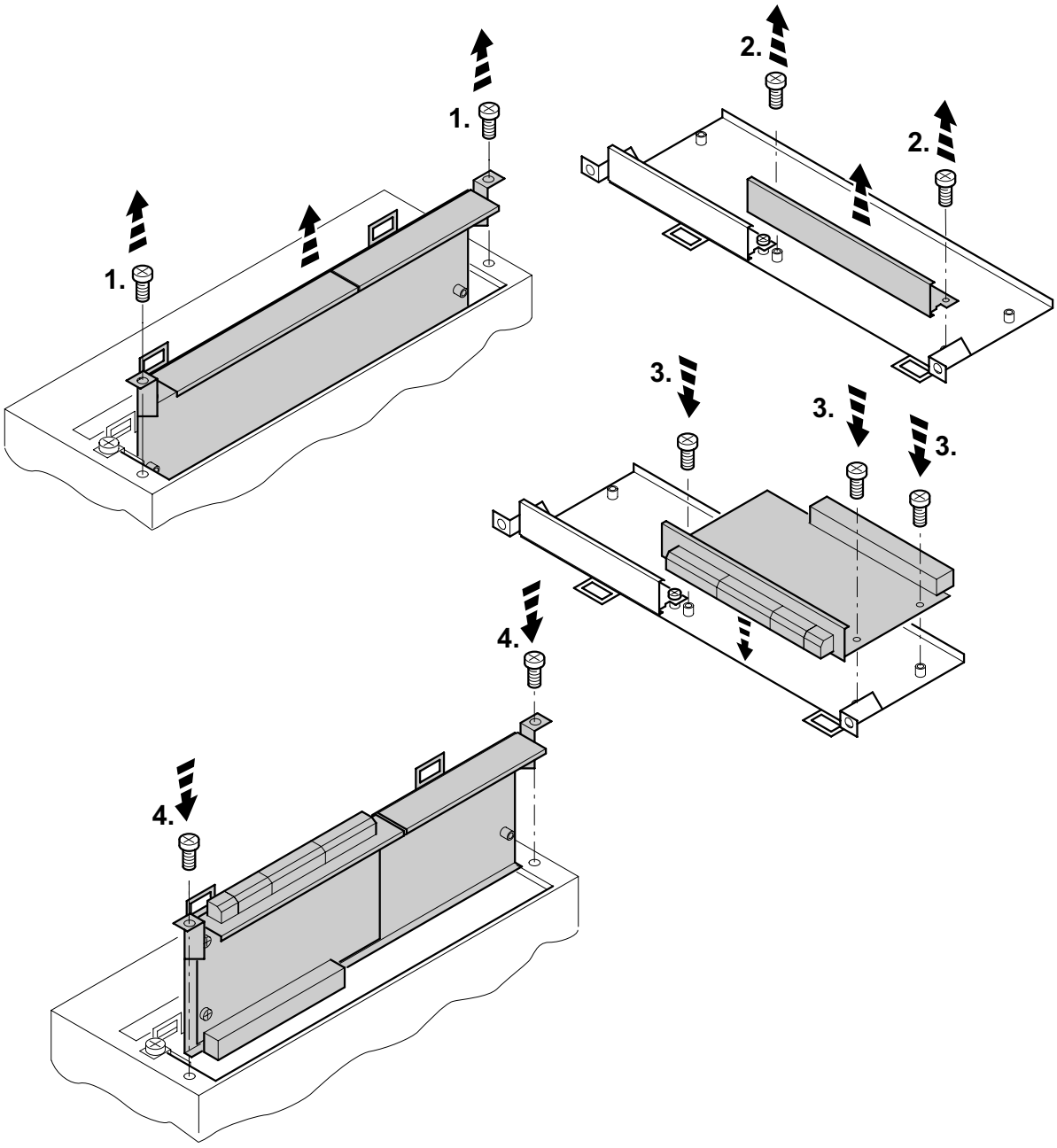


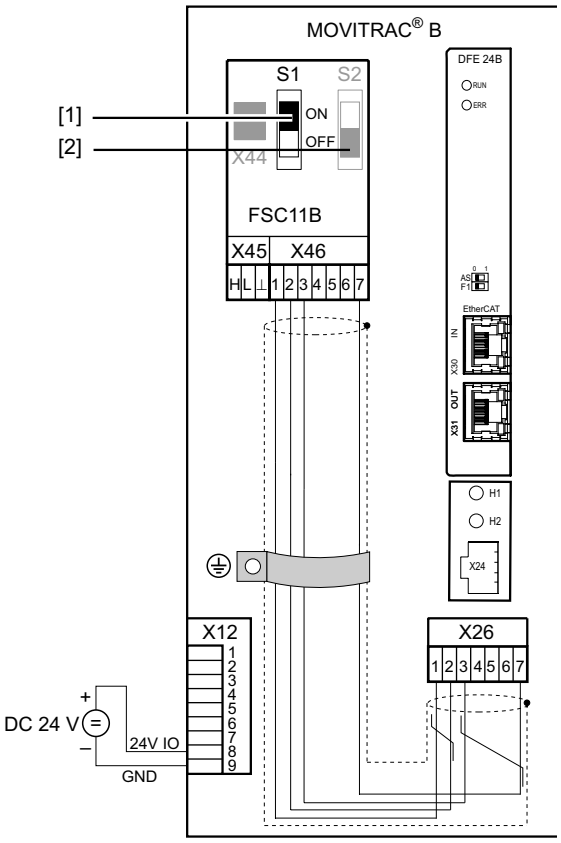
Figure 2: Installing an option card in MOVIDRIVE® MDX61B sizes 1 to 6

1. Remove the two retaining screws holding the card retaining bracket. Pull the card retaining bracket out evenly from the slot (do not twist!).
2. Remove the 2 retaining screws from the black cover plate on the card retaining bracket. Remove the black cover plate.
3. Position the option card onto the retaining bracket so that the 3 retaining screws fit into the corresponding holes on the card retaining bracket.
4. Insert the retaining bracket with the installed option card into the slot, pressing slightly so it is seated properly. Secure the card retaining bracket with the two retaining screws.
5. To remove the option card, follow the instructions in reverse order.

4.2 Installing option card DFE24B in MOVITRAC® B

- MOVITRAC® B does not require any special firmware status.
- Only SEW-EURODRIVE personnel may install or remove options cards into MOVITRAC® B.

4.2.1 SBus connection



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[1] Terminating resistor activated, S1 = ON

[2] DIP switch S2 (reserved), S2 = OFF

- DFE24B has an integrated SBus terminating resistor and must always be installed at the start of the SBus line.
- DFE24B always has the address 0.

X46	X26	
X46:1	X26:1	SC11 SBus +, CAN high
X46:2	X26:2	SC12 SBus –, CAN low
X46:3	X26:3	GND, CAN GND
X46:7	X26:7	DC 24 V

X12	
X12:8	DC 24 V input
X12:9	GND reference potential for binary inputs

For simple cabling, the DFE24B option can be provided with DC 24 V voltage at X26.7 from X46.7 of MOVITRAC® B.

When powering option DFE24B through MOVITRAC® B, MOVITRAC® B itself must be provided with DC 24 V voltage at terminals X12.8 and X12.9.

4.2.2 System bus connection

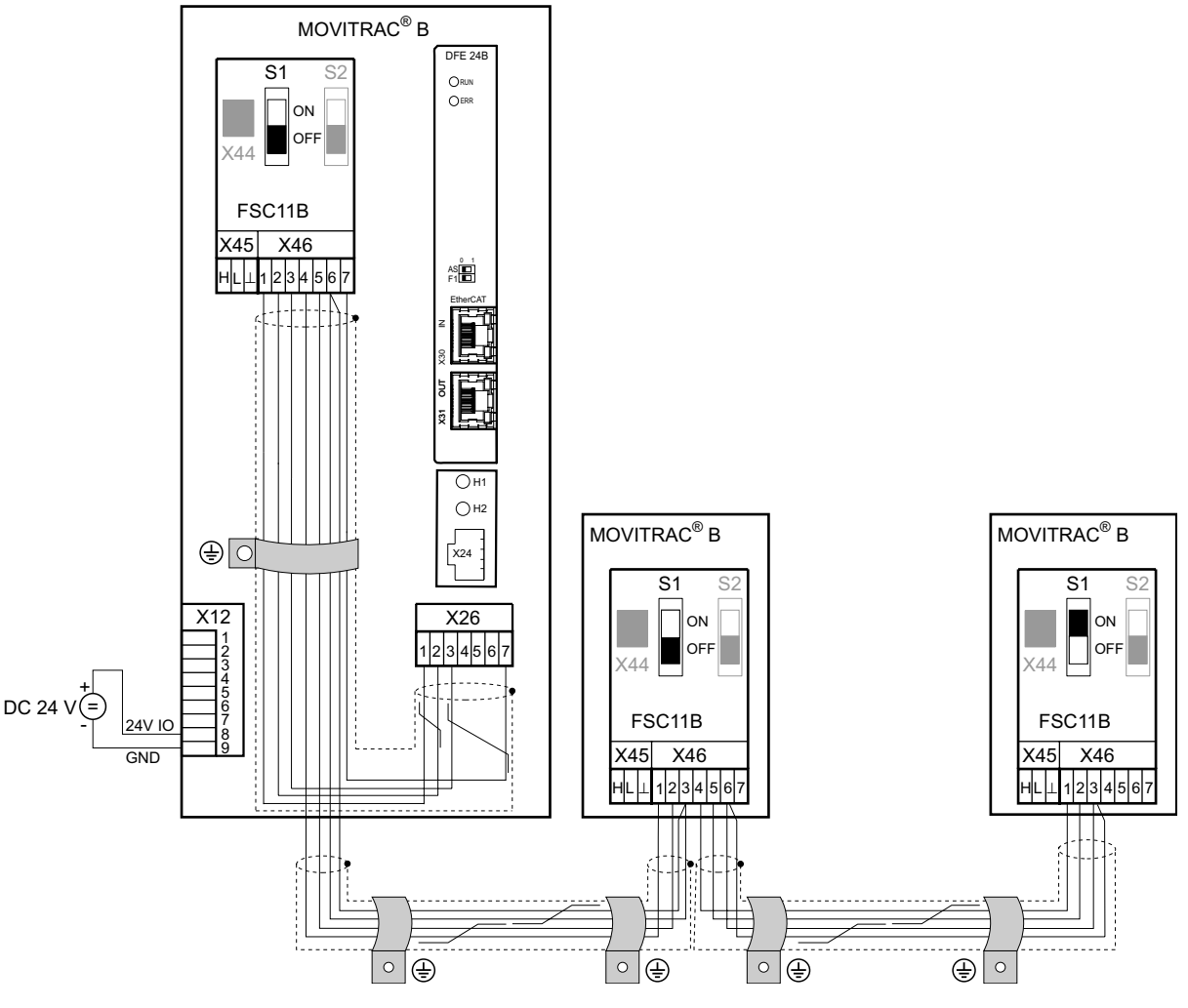

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Figure 3: System bus connection

DFE24B
GND = System bus reference
SC11 = System bus high
SC12 = System bus low

MOVITRAC® B
GND = System bus reference
SC22 = System bus low, outgoing
SC21 = System bus high, outgoing
SC12 = System bus low, incoming
SC11 = System bus high, incoming
S12 = System bus terminating resistor

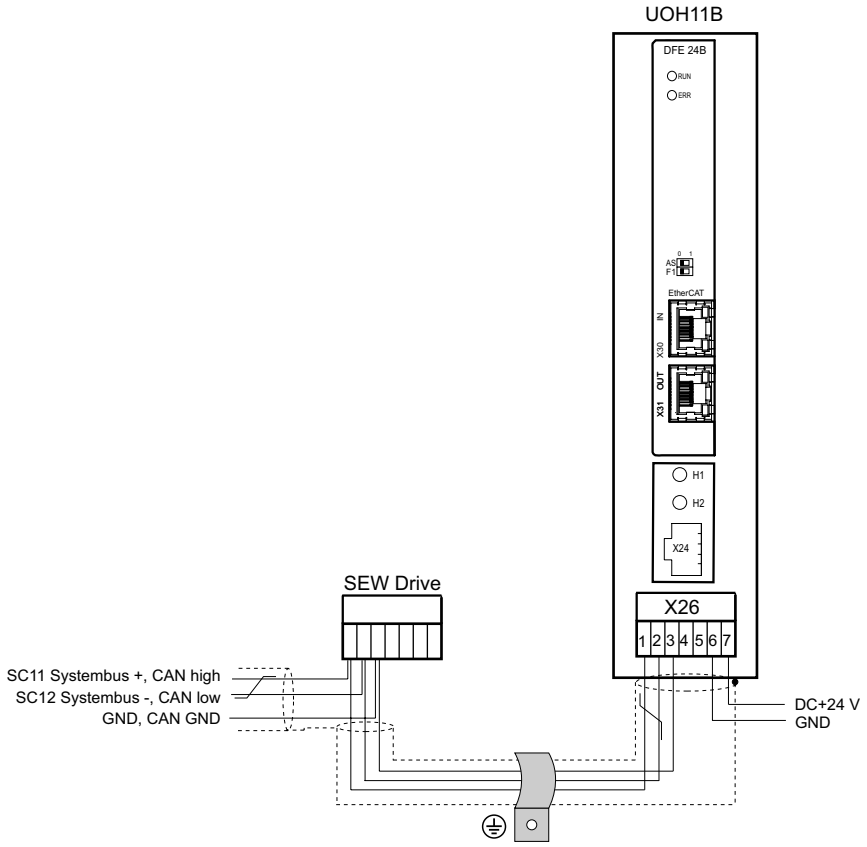
Please note:

- If available, use a 2 x 2 core twisted and shielded copper cable (data transmission cable with braided copper shield). Apply the shield at both ends to the electronics shield clamp of MOVITRAC® B over a large area. When using a 2-core cable connect the shield ends additionally to GND. The cable must meet the following specifications:
  - Core cross section 0.25 ... 0.75 mm^2 (AWG23 ... AWG18)
  - Line resistance 120 Ω at 1 MHz
  - Capacitance per unit length ≤ 40 pF/m at 1 kHz

  Suitable would be CAN bus or DeviceNet cable.
- The permitted total cable length depends on the baud rate setting of the SBus:
  - 250 kBaud: 160 m
  - 500 kBaud: 80 m
  - 1000 kBaud: 40 m
- Connect the system bus terminating resistor (S1 = ON) at the end of the system bus connection. Switch off the terminating resistor on the other units (S1 = OFF). The DFE24B gateway has a permanently installed terminating resistor and must always be located at the beginning or end of the system bus line.
- Star like bus structure is not permitted.

- There must not be any potential displacement between the units connected with the SBus. Take suitable measures to avoid potential displacement, e.g. by connecting the unit ground connectors using a separate lead.

4.3 Installing the UOH11B gateway housing



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X26	
X26:1	SC11 System bus +, CAN high
X26:2	SC12 System bus -, CAN low
X26:3	GND, CAN GND
X26:6	GND, CAN GND
X26:7	DC 24 V

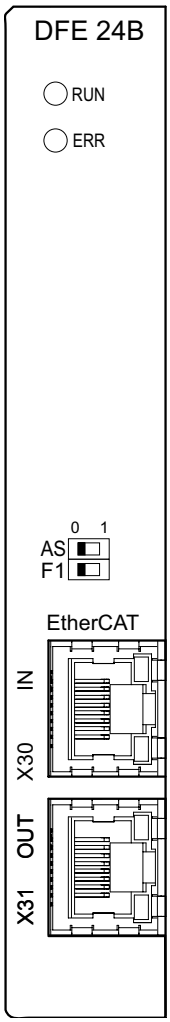
The gateway housing is powered with DC 24 V at X26.

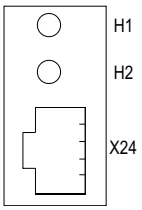
4.4 Connection and terminal description of the DFE24B option

Part number EtherCAT interface type DFE24B: 1821 126 7

The option "EtherCAT interface type DFE24B" is only possible in conjunction with MOVIDRIVE® MDX61B, not with MDX60B.

Plug the DFE24B option into the fieldbus slot.

Front view of DFE24B	Description	DIP switches Terminal	Function
 58083AXX	**RUN: EtherCAT operation LED (orange/green)** **ERR: EtherCAT error LED (red)**		Shows the operating status of bus electronics and communication. Displays EtherCAT errors.
	DIP switch	**AS** **F1**	Auto setup for gateway operation Reserved
	LED Link/Activity (green) **X30 IN: Incoming EtherCAT connection** **LED Link/Activity (green)** **X31 OUT: Outgoing EtherCAT connection**		Shows that the EtherCAT connection with the preceding unit is available/active. Shows that the EtherCAT connection with the following unit is available/active.

Front view in MOVITRAC® B and UOH11B	Description		Function
 58129AXX	**LED H1 (red)** **LED H2 (green)** **X24 X terminal**		System error (only for gateway functionality) Reserved RS485 interface for diagnostics via PC and MOVITOOLS® MotionStudio

4.5 Pin assignment

Use prefabricated, shielded RJ45 plug connectors to IEC11801 edition 2.0, category 5.

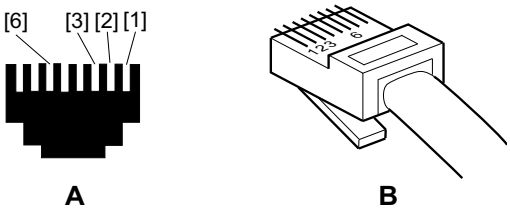


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Figure 4: Pin assignment of an RJ45 plug connector

A = Front view

B = View from back

[1] Pin 1 TX+ Transmit Plus

[2] Pin 2 TX– Transmit Minus

[3] Pin 3 RX+ Receive Plus

[6] Pin 6 RX– Receive Minus

DFE24B - EtherCAT connection

Option DFE24B is equipped with two RJ45 connectors for a linear bus structure. The EtherCAT master is connected (if necessary, via additional EtherCAT slaves) to X30 IN (RJ45) with a shielded, twisted-pair cable. Additional EtherCAT units are then connected via X31 OUT (RJ45).

In accordance with IEC 802.3, the maximum permitted cable length for 100 MBaud Ethernet (100BaseT), e.g. between two DFE24B units, is 100 m.

4.6 Shielding and routing bus cables

Only use shielded cables and connection elements that also meet the requirements of category 5, class D according to IEC 11801 edition 2.0.

Correct shielding of the bus cable attenuates electrical interference that can occur in industrial environments. The following measures ensure the best possible shielding:

- Manually tighten the mounting screws on the connectors, modules, and equipotential bonding conductors.
- Use only connectors with a metal housing or a metallized housing.
- Connect the shielding in the connector over a wide surface area.
- Apply the shielding of the bus line on both ends.
- Route signal and bus cables in separate cable ducts. Do not route them parallel to power cables (motor leads).
- Use metallic, grounded cable racks in industrial environments.
- Route the signal cable and the corresponding equipotential bonding close to each other using the shortest possible route.
- Avoid using plug connectors to extend bus cables.
- Route the bus cables closely along existing grounding surfaces.

In case of fluctuations in the ground potential, a compensating current may flow via the bilaterally connected shield that is also connected to the protective earth (PE). Make sure you supply adequate equipotential bonding according in accordance with relevant VDE regulations in such a case.

4.7 Bus termination

Bus termination (e.g. with bus terminating resistors) is not necessary. If no further device is connected to an EtherCAT slave, it recognizes this automatically.

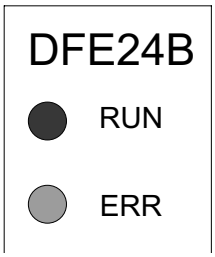
4.8 Setting the station address

EtherCAT devices from SEW-EURODRIVE do not have an address that can be set on the unit. The units are detected by their position in the bus structure and are assigned an address by the EtherCAT master. The addresses can be displayed, for example, using the DBG60B keypad (parameter P093).

4.9 Operating displays of the DFE24B option

4.9.1 EtherCAT LEDs

There are two LEDs on the DFE24B EtherCAT option card that display the current status of the DFE24B option and the EtherCAT system.



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LED RUN (green/orange)

The **RUN** LED (green/orange) signals the status of option DFE24B.

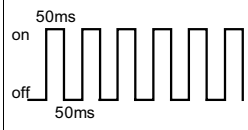
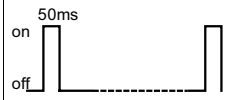
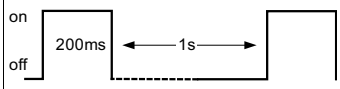
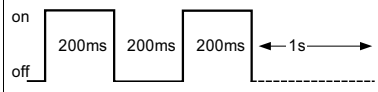
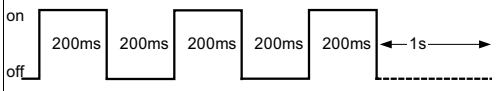
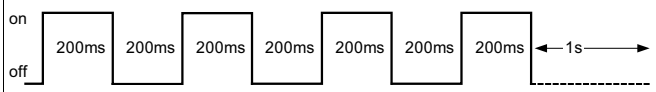
Status	State	Description
Off	INIT	Option DFE24B is in the state INIT.
Flashing green	PRE-OPERATIONAL	Option DFE24B is in the state PRE-OPERATIONAL.
Lights up once (green)	SAFE-OPERATIONAL	Option DFE24B is in the state SAFE-OPERATIONAL.
Green	OPERATIONAL	Option DFE24B is in the state OPERATIONAL.
Flickering green	INITIALISATION or BOOTSTRAP	• Option DFE24B is booting and has not yet reached the state INIT. • Option DFE24B is in the state BOOTSTRAP. The firmware is being downloaded.
Flashing orange	NOT CONNECTED	Option DFE24B has been switched on but has not yet been addressed by an EtherCAT master.

LED ERR (red)

The **ERR** LED (red) signals an error on EtherCAT.

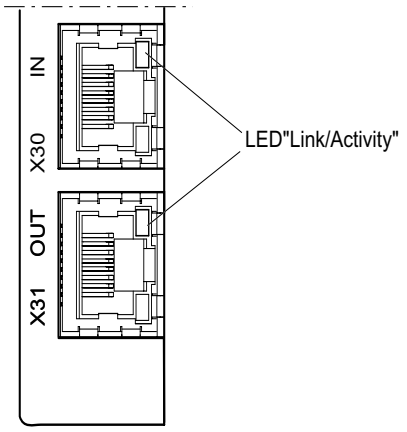
Status	Error	Description
Off	No error	EtherCAT communication of the DFE24B option is in the operating state.
Flickering	Boot error	A boot error has been detected. The state INIT was achieved, but the "Change" parameter in the AL status register has been set to "0x01:change/error".
Flashing	Invalid configuration	General configuration error.
Lights up once	Unrequested change in status	The slave application has changed the EtherCAT state automatically. The "Change" parameter in the AL status register has been set to "0x01:change/error".
Lights up twice	Application watchdog timeout	A watchdog timeout occurred in the application.
Lights up three times	Reserved	-
Lights up four times	Reserved	-
On	PDI watchdog timeout	A PDI watchdog timeout occurs.

Definition of the display statuses

Display	Definition	Time profile
On	Display is always switched on.	
Off	Display is always switched off.	
Flickering	Display switches on and off at a frequency of 10 Hz.	 58094AXX
Lights up briefly once	The display lights up briefly, followed by on off phase.	 58095AXX
Flashing	Display switches on and off at a frequency of 2.5 Hz (200 ms on, 200 ms off).	 58096AXX
Lights up once	The display lights up once (200 ms), followed by a longer off phase (1000 ms).	 58097AXX
Lights up twice	The display lights up twice in succession, followed by on off phase.	 58100AXX
Lights up three times	The display lights up three times in succession, followed by on off phase.	 58101AXX
Lights up four times	The display lights up four times in succession, followed by on off phase.	 58102AXX

LED Link/Activity (green)

Each EtherCAT connection has a "Link/Activity" LED for the incoming EtherCAT cable (X30) and the outgoing EtherCAT cable (X31). They signal whether the EtherCAT connection to the preceding (X30) or following (X31) unit is available / active.



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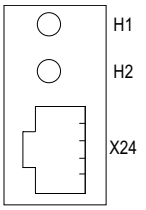
4.9.2 Gateway LED

LEDs for the gateway communication status



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LED H1 Sys-Fault (red)	Only for gateway function	
Status	**State**	**Description**
Red	System error	Gateway not configured or one of the drives is inactive
Off	SBus ok	Gateway is configured correctly
Flashes	Bus scan	Bus is being checked by the gateway

LED **H2** (green) is reserved at present.

X terminal X24 is the RS485 interface for diagnostics via PC and MOVITOOLS® MotionStudio.

5 Configuration and Startup

This section provides you with information on configuration for the EtherCAT master and startup of the drive inverter for fieldbus operation.

The current version of the XML file for the DFE24B control card is available on the SEW homepage (http://sew-eurodrive.de) under the heading "Software."

5.1 Validity of the XML files for DFE24B

The XML file is needed when DFE24B is used as a fieldbus option in MOVIDRIVE® B **and** as a gateway in MOVITRAC® B or a gateway housing (UOH11B).

Do not change or expand the entries in the XML file. SEW assumes no liability for inverter malfunctions caused by a modified XML file!

5.2 Configuring the EtherCAT master for MOVIDRIVE® B with the XML file

5.2.1 XML for operation in MOVIDRIVE® B

An XML file (SEW_DFE24B.XML) is available for configuring the EtherCAT master. Copy this file to a folder in the configuration software.

Refer to the manuals for the appropriate configuration software for details on this procedure.

The XML files standardized by the EtherCAT Technology Group (ETG) can be read by all EtherCAT masters.

5.2.2 Configuration procedure

Proceed as follows to configure MOVIDRIVE® B with EtherCAT fieldbus interface:

1. Install (copy) the XML file according to the specifications of your configuration software. Once the file has been installed correctly, the device appears next to the slave stations (under SEW EURODRIVE → Drives) with the designation *MOVIDRIVE+DFE24B*.
2. Use the [Insert] menu item to add the device to the EtherCAT structure. The address is assigned automatically. You can give the device a name to make it easier to identify.
3. Select the process data configuration required for your application (see section 5.2.3).
4. Connect the I/O or periphery data to the input and output data of the application program.

Once configuration is complete, you can start EtherCAT communication. The LEDs RUN and ERR indicate the communication status of option DFE24B (see section 4.9 "Operating displays of the DFE24B option").

5.2.3 PDO configuration for operation in MOVIDRIVE®

In the CoE (CANopen over EtherCAT) variant, EtherCAT uses the process data objects (PDO) defined in the CANopen standard for cyclical communication between master and slave. CANopen Standard distinguishes between the process data objects Rx (Receive) and Tx (Transmit).

Rx process data objects

Rx process data objects (Rx-PDO) are received by the EtherCAT slave. They transfer process output data (control values, setpoints, digital output signals) from the EtherCAT master to the EtherCAT slave.

Tx process data objects

Tx process data objects (TX-PDO) are returned from the EtherCAT slave to the EtherCAT master. They transfer process input data (actual values, status, digital input information, etc.).

In the DFE24B operating mode of MOVIDRIVE® B, two different PDO types can be used for cyclical process input and output data.

- *OutputData1* (Standard 10 PO)

  Static PDO with 10 cyclical process output data words that are connected in fixed configuration with the standard process data of MOVIDRIVE® B (→ "MOVIDRIVE® Fieldbus Unit Profile" manual).

- *OutputData2* (Configurable PO)

  Configurable PDO with up to 10 cyclical process output data words (16 Bit) and up to 8 cyclical system variables (32 Bit) that can be configured as required and connected to various process data of the drive inverter.

- *InputData1* (Standard 10 PI)

  Static PDO with 10 cyclical process input data words that are connected in fixed configuration with the standard process data of MOVIDRIVE® B (→ "MOVIDRIVE® Fieldbus Unit Profile" manual).

- *InputData2* (Configurable PI)

  Configurable PDO with up to 10 cyclical process input data words (16 Bit) and up to 8 cyclical system variables (32 Bit) that can be configured as required and connected to various process data of the drive inverter.

List of the possible process data objects (PDO) for DFE24B MOVIDRIVE® B

Index	Size	Name	Mapping	Sync manager	Sync unit
1600hex (5632dec)	20 bytes	OutputData1 (Standard 10 PDO)	Fixed content	2	0
1602hex (6656dec)	2 ... 52 bytes	OutputData2 (Configurable PO)	-	2	0
1A00hex (5632dec)	20 bytes	InputData1 (Standard 10 PI)	Fixed content	3	0
1A02hex (6658dec)	2 ... 52 bytes	InputData2 (Configurable PI)	-	3	0

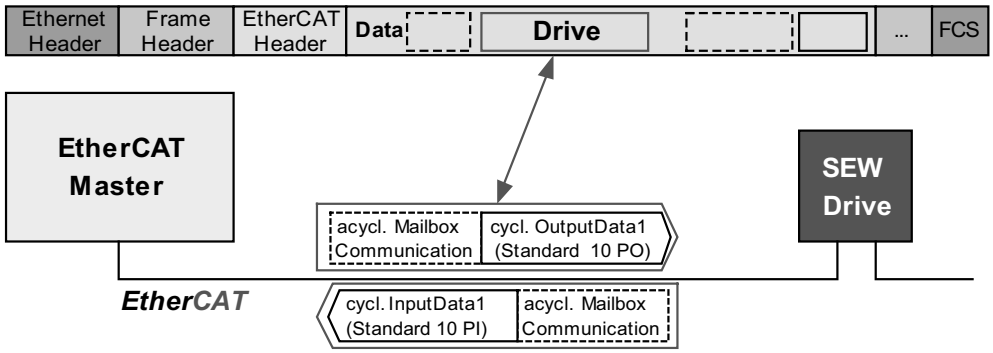

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Figure 5: Use of the process data objects OutputData1 and InputData1

Static PDO for 10 cyclic process data words

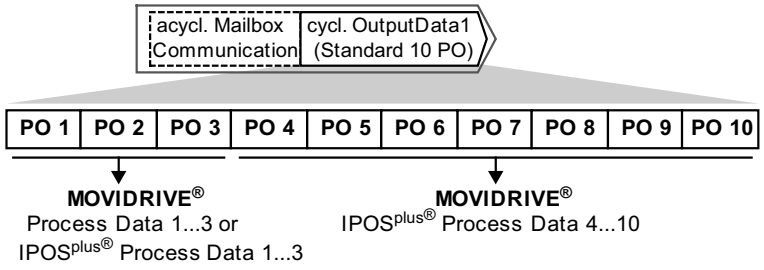

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Figure 6: Assignment of standard process output data for OutputData1

The process output data transferred with *OutputData1* are assigned according to the following table. The process output data PO1 ... PO3 can be connected with various process data (control words, setpoints) using the process data configuration in the MOVIDRIVE® B drive inverter (→ "MOVIDRIVE® Fieldbus Unit Profile" manual). The process output data PO4 ... PO10 are only available in IPOS$^{plus®}$.

Fixed assignments of the configured process output data for PDO OutputData1

Index.Subindex	Offset in PDO	Name	Data type	Size in bytes
3DB8.0hex (15800.0dec)	0.0	PO1	UINT	2
3DB9.0hex (15801.0dec)	2.0	PO2	UINT	
3DBA.0hex (15802.0dec)	4.0	PO3	UINT	
3DBB.0hex (15803.0dec)	6.0	PO4	UINT	
3DBC.0hex (15804.0dec)	8.0	PO5	UINT	
3DBD.0hex (15805.0dec)	10.0	PO6	UINT	
3DBE.0hex (15806.0dec)	12.0	PO7	UINT	
3DBF.0hex (15807.0dec)	14.0	PO8	UINT	
3DC0.0hex (15808.0dec)	16.0	PO9	UINT	
3DC1.0hex (15809.0dec)	18.0	PO10	UINT	

Fixed assignment of the configured process input data for PDO InputData1

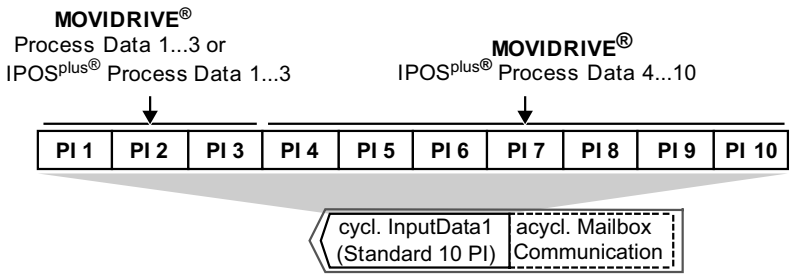

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Figure 7: Assignment of the standard process input data for PDO InputData1

The process input data transferred with *InputData1* are assigned according to the following table. The process input data PI1 ... PI3 can be connected with various process data (status words, actual values) using the process data configuration in the MOVIDRIVE® B drive inverter (→ "MOVIDRIVE® Fieldbus Unit Profile" manual). The process input data PI4 ... PI10 are only available in IPOSplus®.

Index.Subindex	Offset in PDO	Name	Data type	Size in bytes
3E1C.0hex (15900.0dec)	0.0	PI1	UINT	2
3E1D.0hex (15901.0dec)	2.0	PI2	UINT	
3E1E.0hex (15902.0dec)	4.0	PI3	UINT	
3E1F.0hex (15903.0dec)	6.0	PI4	UINT	
3E20.0hex (15904.0dec)	8.0	PI5	UINT	
3E21.0hex (15905.0dec)	10.0	PI6	UINT	
3E22.0hex (15906.0dec)	12.0	PI7	UINT	
3E23.0hex (15907.0dec)	14.0	PI8	UINT	
3E24.0hex (15908.0dec)	16.0	PI9	UINT	
3E25.0hex (15909.0dec)	18.0	PI10	UINT	

If fewer than 10 process data words are to be transferred, or if the PDO mapping is to be adjusted, the configurable PDOs are to be used instead of the static PDO.

Configurable PDO for up to 8 IPOS-plus® variables and 10 process data words

The process data transferred with *OutputData2* and *InputData2* can be configured as required with process data information according to the following table. 32-bit variables of type DINT and standard process data PO1 ... PO10 and PI1 ... PI10 can be configured. In this way, the PDO can be configured to suit any application.

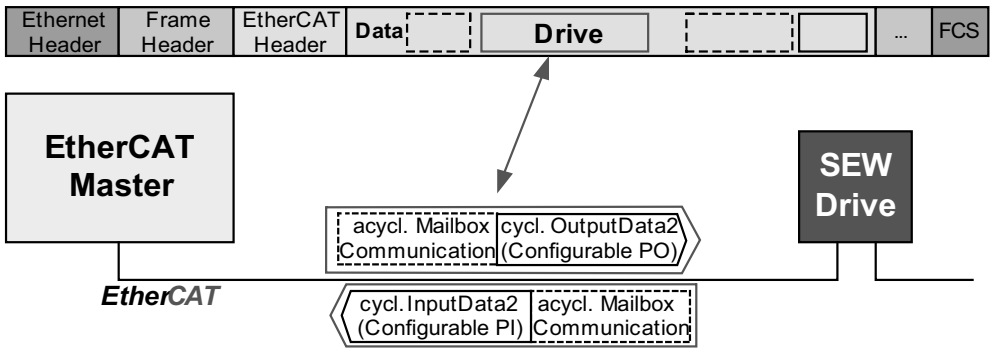

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Figure 8: Use of the configurable PDO OutputData2, InputData2

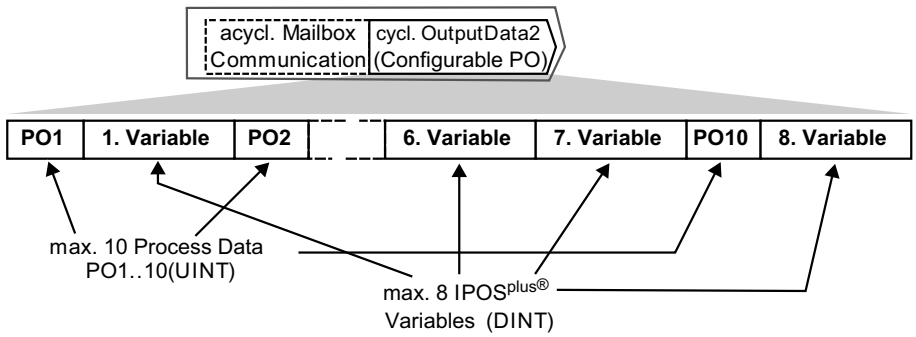

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Figure 9: Configurable PDO mapping for OutputData2

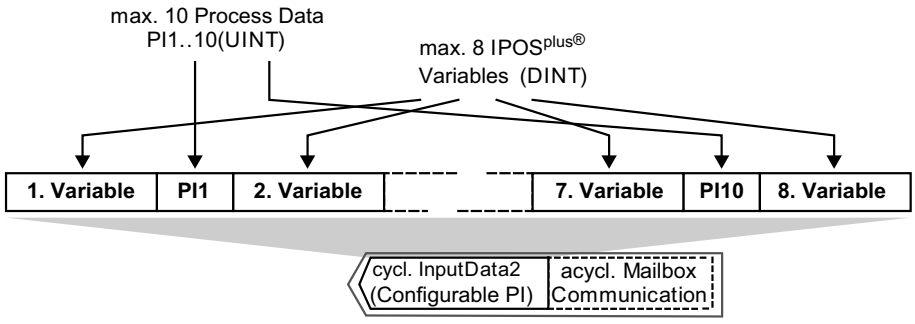

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Figure 10: Configurable PDO mapping for InputData2

Assignment of the configurable process input and output data for PDO OutputData2 and InputData2

The maximum amount of configurable PDO *OutputData2* and *InputData2* data is

- 10 process data words (type UINT)
- 8 IPOS$^{plus®}$ variables (type DINT)

Index.Subindex	Name	Data type	Size in bytes	Read Write	Access attribute
2AF8.0hex (11000.0dec)	Template Ipos-Var (0...1023)	DINT	4	4	Template for IPOS$^{plus®}$ variables
2CBD.0hex (11453.0dec)	ModuloCtrl (H453)				Control word of the Modulo function
2CBE.0hex (11454.0dec)	ModTagPos (H454)				Modulo target position
2CBF.0hex (11455.0dec)	ModActPos (H455)				Modulo actual position
2CC0.0hex (11456.0dec)	ModCount (H456)				Modulo counter value
2CD1.0hex (11473.0dec)	StatusWord (H473)				IPOS status word
2CD2.0hex (11474dec)	Scope474				Direct Scope variable
2CD3.0hex (11475.0dec)	Scope475 H475)				Direct Scope variable
2CD6.0hex (11478.0dec)	AnaOutIPOS2 (H478)				Analog output 2 option DIO11B
2CD7.0hex (11478.0dec)	AnaOutIPOS (H479)				Analog output option DIO11B
2CD8.0hex (11480.0dec)	OptOutIPOS (H480)				Optional digital outputs
2CD9.0hex (11481.0dec)	StdOutIPOS (H481)				Standard digital outputs
2CDA.0hex (11482.0dec)	OutputLevel (H482)				Status of the digital outputs
2CDB.0hex (11483.0dec)	InputLevel (H483)				Status of the digital inputs
2CDC.0hex (11484.0dec)	ControlWord (H484)				IPOSplus® control word
2CE4.0hex (11492.0dec)	TargetPos (H492)				Target position
2CE7.0hex (11495.0dec)	LagDistance (H495)				Lag distance
2CEB.0hex (11499.0dec)	SetpPosBus (H499)				Bus position setpoint
2CEC.0hex (11500.0dec)	TpPos2_VE (H500)				Touch probe position 2 virtual encoder
2CED.0hex (11501.0dec)	TpPos1_VE (H501)				Touch probe position 1 virtual encoder
2CEE.0hex (11502.0dec)	TpPos2_Abs (H502)				Touch probe position 2
2CEF.0hex (11503dec)	TpPos1_Abs (H503)				Touch probe position 1

Index.Subindex	Name	Data type	Size in bytes	Read Write	Access attribute
2CF0.0hex (11504.0dec)	TpPos2_Ext (H504)	DINT	4	4	Touch probe position 2 external
2CF1.0hex (11505.0dec)	TpPos2_Mot (H505)				Touch probe position 2 motor encoder
2CF2.0hex (11506.0dec)	TpPos1_Ext (H506)				Touch probe position 1 external
2CF3.ohex (11507.0dec)	TpPos1_Mot (H507)				Touch probe position 1 motor
2CF4.0hex (11508.0dec)	ActPos_Mot16 bit (H508)				Actual position motor 16 Bit
2CF5.0hex (11509dec)	ActPos_Abs (H509)				Actual position absolute encoder
2CF6.0hex (11510.0dec)	ActPos_Ext (H510)				Actual position external encoder X14
2CF7.0hex (11511.0dec)	ActPos_Mot (H511)				Actual position motor encoder
3DB8.0hex (15800.0dec)	PO1	UINT	2	2	Standard process output data word PO1
3DB9.0hex (15801.0dec)	PO2				Standard process output data word PO2
3DBA.0hex (15802.0dec)	PO3				Standard process output data word PO3
3DBB.0hex (15803.0dec)	PO4				Standard process output data word PO4
3DBC.0hex (15804.0dec)	PO5				Standard process output data word PO5
3DBD.0hex (15805.0dec)	PO6				Standard process output data word PA6
3DBE.0hex (15806.0dec)	PO7				Standard process output data word PO7
3DBF.0hex (15807.0dec)	PO8				Standard process output data word PO8
3DC0.0hex (15808.0dec)	PO9				Standard process output data word PO9
3DC1.0hex (15801.0dec)	PO10				Standard process output data word PO10
3E1C.0hex (15900.0dec)	PI1				Standard process input data word PI1
3E1D.0hex (1590010dec)	PI2				Standard process input data word PI2
3E1E.0hex (15902.0dec)	PI3				Standard process input data word PI3
3E1F.0hex (15903.0dec)	PI4				Standard process input data word PI4
3E20.0hex (15904.0dec)	PI5				Standard process input data word PI5
3E21.0hex (15905.0dec)	PI6				Standard process input data word PI6
3E22.0hex (15906.0dec)	PI7				Standard process input data word PI7
3E23.0hex (15907.0dec)	PI8				Standard process input data word PI8
3E24.0hex (15908.0dec)	PI9				Standard process input data word PI9
3E25.0hex (15909.0dec)	PI10				Standard process input data word PI10

Plausibility of the configuration of process data objects:

- In the freely configurable process data objects *OutputData2* and *InputData2*, cyclical process output data PO1 ... 10 cannot be inserted when *OutputData1* or *InputData1* is configured at the same time.
- Multiple configuration of process data objects is not possible.
- Only standard process data objects PO1 ... PO10, PI1 ... PI10 or IPOS$^{plus®}$ variables (indices 11000.0 ... 12023.0) can be configured as process data.

5.3 Configuring the EtherCAT master for MOVITRAC® B / gateway with XML file

This section describes the configuration of the EtherCAT master with MOVITRAC® B and the DFE24B gateway / UOH11B.

5.3.1 XML files for operation in MOVITRAC® B and gateway housing UOH11B

An XML file (SEW_DFE24B.XML) is available for configuring the EtherCAT master. Copy this file to a folder in the configuration software.

Refer to the manuals for the appropriate configuration software for details on this procedure.

The XML files standardized by the EtherCAT Technology Group (ETG) can be read by all EtherCAT masters.

5.3.2 Configuration procedure

Proceed as follows to configure MOVITRAC® / gateways with the EtherCAT interface:

1. Install (copy) the XML file according to the specifications of your configuration software. Once the file has been installed correctly, the device appears next to the slave stations (under SEW EURODRIVE → Drives) with the designation *DFE24B-Gateway*.
2. Use the [Insert] menu item to add the device to the EtherCAT structure. The address is assigned automatically. You can give the device a name to make it easier to identify.
3. Connect the I/O or periphery data to the input and output data of the application program.

Once configuration is complete, you can start EtherCAT communication. The LEDs RUN and ERR indicate the communication status of option DFE24B (see section 4.9 "Operating displays of the DFE24B option").

5.3.3 PDO configuration for DFE24B gateway for MOVITRAC® B

In the DFE24B gateway operating mode for MOVITRAC® B, one PDO each is used for cyclical process input and output data.

- *OutputData1* (Standard 24 PO)

  Static PDO with 24 cyclical process output data words that are connected in fixed configuration with the process data of a maximum of 8 MOVITRAC® B connected to the gateway.

- *InputData1* (Standard 24 PI)

  Static PDO with 24 cyclical process input data words that are connected in fixed configuration with the process data of a maximum of 8 MOVITRAC® B connected to the gateway.

List of the possible PDO for the DFE24B gateway:

Index	Size	Name	Mapping	Sync manager	Sync unit
1601hex (5633dec)	48 bytes	OutputData1 (Standard 24 PO)	Fixed content	2	0
1A01hex (5633dec)	48 bytes	InputData1 (Standard 24 PI)	Fixed content	3	0

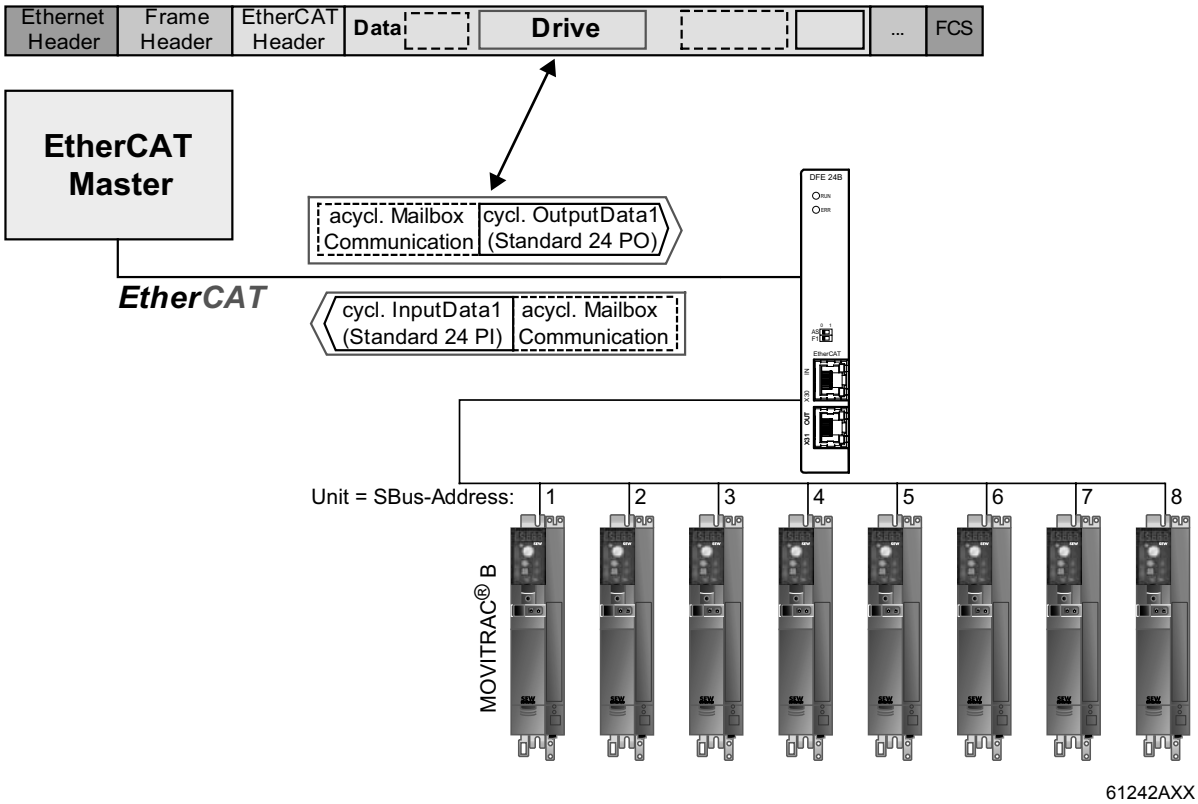

Figure 11: Data exchange (PDO OutputData1, InputData1) with EtherCAT master

Assignment of the fixed configured process output data (PDO 1)

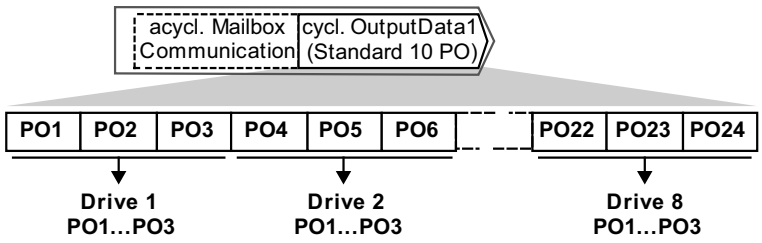

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Figure 12: Assignment of standard process output data for OutputData1

The process output data transferred with *OutputData1* are assigned according to the following table. For each inverter, the process output data PO1 ... PO3 can be connected with various process data (control words, setpoints) using the process data configuration in the MOVITRAC® B drive inverter (→ "MOVITRAC® B" operating instructions).

Index.Subindex	Offset in PDO	Name	Assignment	Data type	Size in bytes
3DB8.0hex (15800.0dec)	0.0	PO1	Drive 1 PO1	UINT	2
3DB9.0hex (15801.0dec)	2.0	PO2	Drive 1 PO2		
3DBA.0hex (15802.0dec)	4.0	PO3	Drive 1 PO3		
3DBB.0hex (15803.0dec)	6.0	PO4	Drive 2 PO1		
3DBC.0hex (15804.0dec)	8.0	PO5	Drive 2 PO2		
3DBD.0hex (15805.0dec)	10.0	PO6	Drive 2 PO3		
3DBE.0hex (15806.0dec)	12.0	PO7	Drive 3 PO1		
3DBF.0hex (15807.0dec)	14.0	PO8	Drive 3 PO2		
3DC0.0hex (15808.0dec)	16.0	PO9	Drive 3 PO3		
3DC1.0hex (15809.0dec)	18.0	PO10	Drive 4 PO1		
3DC2.0hex (15810.0dec)	0.0	PO11	Drive 4 PO2		
3DC3.0hex (15811.0dec)	2.0	PO12	Drive 4 PO3		
3DC4.0hex (15812.0dec)	4.0	PO13	Drive 5 PO1		
3DC5.0hex (15813.0dec)	6.0	PO14	Drive 5 PO2		
3DC6.0hex (15814.0dec)	8.0	PO15	Drive 5 PO3		

Index.Subindex	Offset in PDO	Name	Assignment	Data type	Size in bytes
3DC7.0hex (15815.0dec)	10.0	PO16	Drive 6 PO1	UINT	2
3DC8.0hex (15816.0dec)	12.0	PO17	Drive 6 PO2		
3DC9.0hex (15817.0dec)	14.0	PO18	Drive 6 PO3		
3DCA.0hex (15818.0dec)	16.0	PO19	Drive 7 PO1		
3DCB.0hex (15819.0dec)	18.0	PO20	Drive 7 PO2		
3DCC.0hex (15820.0dec)	18.0	PO21	Drive 7 PO3		
3DCD.0hex (15821.0dec)	18.0	PO22	Drive 8 PO1		
3DCE.0hex (15822.0dec)	18.0	PO23	Drive 8 PO2		
3DCF.0hex (15823.0dec)	18.0	PO24	Drive 8 PO3		

Assignment of the fixed configured process input data (PDO 1)

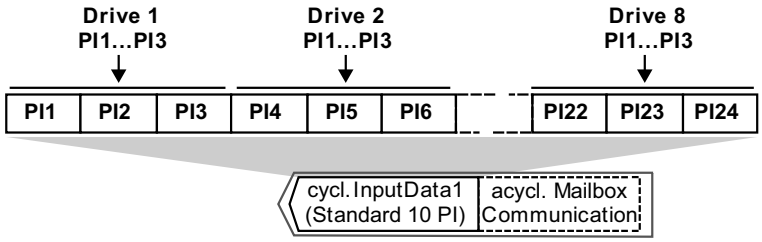

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Figure 13: Assignment of the standard process input data for InputData1

The process input data transferred with *InputData1* are assigned according to the following table. The process input data PI1 ... PI3 can be connected with various process data (status words, actual values) using the process data configuration in the MOVITRAC® B drive inverter (→ "MOVITRAC® B" operating instructions).

Index.Subindex	Offset in PDO	Name	Assignment	Data type	Size in bytes
3E1C.0hex (15900.0dec)	0.0	PI1	Drive 1 PI1	UINT	2
3E1D.0hex (15901.0dec)	2.0	PI2	Drive 1 PI2		
3E1E.0hex (15902.0dec)	4.0	PI3	Drive 1 PI3		
3E1F.0hex (15903.0dec)	6.0	PI4	Drive 2 PI1		
3E20.0hex (15904.0dec)	8.0	PI5	Drive 2 PI2		
3E21.0hex (15905.0dec)	10.0	PI6	Drive 2 PI3		
3E22.0hex (15906.0dec)	12.0	PI7	Drive 3 PI1		
3E23.0hex (15907.0dec)	14.0	PI8	Drive 3 PI2		
3E24.0hex (15908.0dec)	16.0	PI9	Drive 3 PI3		
3E25.0hex (15909.0dec)	18.0	PI10	Drive 4 PI1		
3E26.0hex (15910.0dec)	20.0	PI11	Drive 4 PI2		
3E27.0hex (15911.0dec)	22.0	PI12	Drive 4 PI3		
3E28.0hex (15912.0dec)	24.0	PI13	Drive 5 PI1		
3E29.0hex (15913.0dec)	26.0	PI14	Drive 5 PI2		
3E2A.0hex (15914.0dec)	28.0	PI15	Drive 5 PI3		

Index.Subindex	Offset in PDO	Name	Assignment	Data type	Size in bytes
3E2B.0hex (15915.0dec)	30.0	PI16	Drive 6 PI1	UINT	2
3E2C.0hex (15916.0dec)	32.0	PI17	Drive 6 PI2		
3E2D.0hex (15917.0dec)	34.0	PI18	Drive 6 PI3		
3E2E.0hex (15918.0dec)	36.0	PI19	Drive 7 PI1		
3E2F.0hex (15919.0dec)	38.0	PI20	Drive 7 PI2		
3E30.0hex (15920.0dec)	40.0	PI21	Drive 7 PI3		
3E31.0hex (15921.0dec)	42.0	PI22	Drive 8 PI1		
3E32.0hex (15922.0dec)	44.0	PI23	Drive 8 PI2		
3E33.0hex (15923.0dec)	46.0	PI24	Drive 8 PI3		

5.3.4 Auto setup for gateway operation

The auto setup function can be used to startup DFE24B as a gateway without a PC. The function is activated using the DIP switch Auto-Setup (see section 4.4 on page 19) .

Setting the DIP switch Auto-Setup (AS) from OFF to ON position causes the function to be executed once. **The Auto-Setup DIP switch must then remain in ON position.** The function can be reactivated by turning the DIP switch off and back on again.

First, the DFE24B searches on the lower-level SBus for SEW drives. This process is indicated by the LED **H1** (system error) flashing briefly. For this purpose, different SBus addresses must be set for the drive inverters (P881). We recommend assigning the addresses beginning with address 1 in ascending order based on the arrangement of inverters in the control cabinet. The process image on the fieldbus side is expanded by three words for each detected drive inverter.

The LED **H1** remains lit if no drive inverter is located. A total of up to 8 drive inverters is taken into account.

After the search is completed, the DFE24B cyclically exchanges 3 process data words with each connected drive inverter. The process output data is taken from the fieldbus, divided into blocks of three and transmitted. The drive inverters read the process input data, put it together and send it to the fieldbus master.

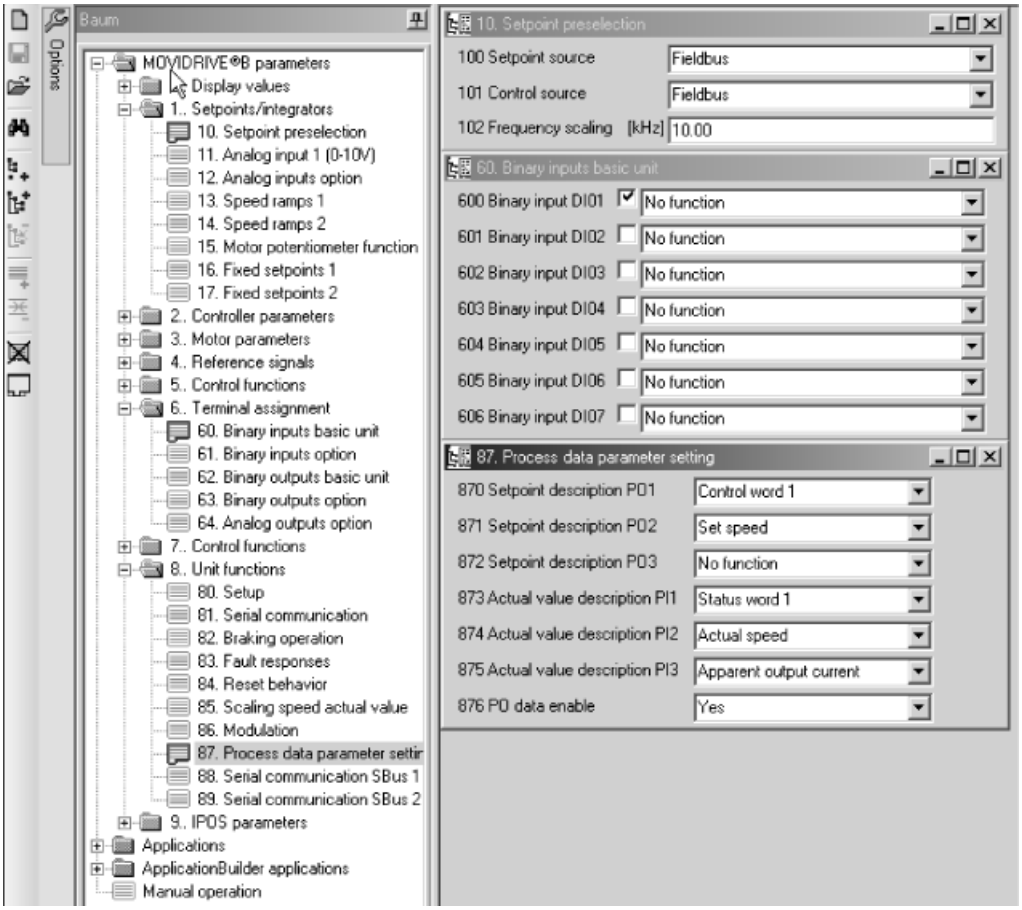
The cycle time of SBus communication is 2 ms per station.

For an application with 8 inverters on the SBus, the cycle time for the process data update will be 8 x 2 ms = 16 ms.

If you change the process data assignment of the drive inverters connected to DFE24B, you must activate Auto-Setup again because the DFE24B saves these values only once during Auto-Setup. At the same time, the process data assignments of the connected drive inverters may not be changed dynamically after Auto-Setup.

5.4 Setting the MOVIDRIVE® MDX61B drive inverter

The following settings must be made for simple fieldbus operation.



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However, to control the MOVIDRIVE® B drive inverter via EtherCAT, you must first switch the drive inverter to control signal source (P101) and setpoint source (P100) = FIELDBUS. The FIELDBUS setting means the drive inverter parameters are set for control and setpoint entry via EtherCAT. The MOVIDRIVE® B drive inverter now responds to the process output data transmitted from the PLC.

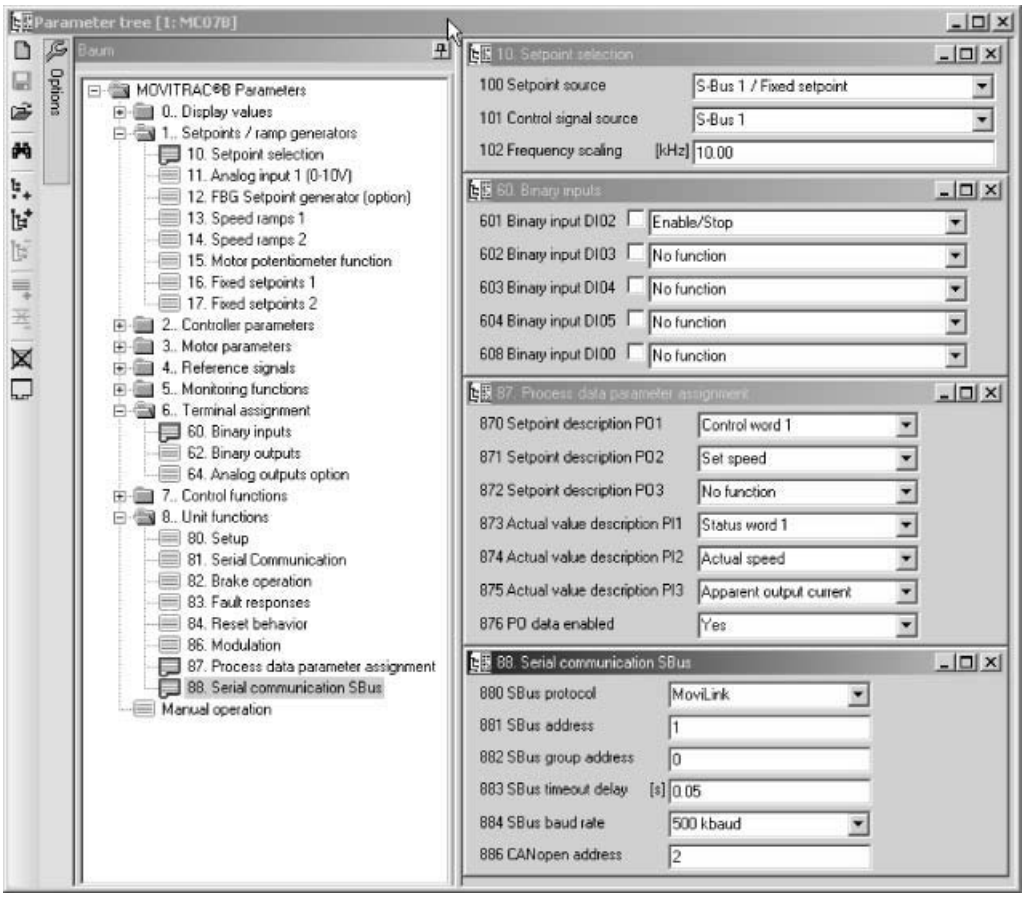
The parameters of the MOVIDRIVE® B drive inverter can be set straight away via EtherCAT without any further settings once the EtherCAT option card has been installed. For example, all parameters can be set by the master programmable controller after power-on.

Activation of the control signal source and setpoint source FIELDBUS is signaled to the machine controller using the "Fieldbus mode active" bit in the status word.

For safety reasons, you must also enable the MOVIDRIVE® B drive inverter at the terminals for control via the fieldbus system. Consequently, you must wire and program the terminals in such a way that the inverter is enabled via the input terminals. The simplest way of enabling the inverter on the terminal side is to set the DIØØ input terminal (Function /CONTROLLER INHIBIT) to a +24 V signal and to program the input terminals DIØ1 ... DIØ7 to NO FUNCTION.

The whole procedure for starting up the MOVIDRIVE® B drive inverter with EtherCAT connection is described in sections 6 and 7.

5.5 Setting the MOVITRAC® frequency inverter



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To control the MOVITRAC® B frequency inverter via EtherCAT, you must first switch the inverter to *Control signal source (P101)* and *Setpoint source (P100)* = SBus. The SBus setting means the MOVITRAC® B frequency inverter parameters are set for setpoint transfer from the gateway. The MOVITRAC® B frequency inverter now responds to the process output data transmitted from the PLC.

To ensure that the MOVITRAC® B frequency inverter stops when SBus communication is interrupted, set the SBus1 timeout time (P883) to a value other than 0 ms. We recommend a value between 50 and 200 ms.

Activation of the control signal source and setpoint source SBus is signaled to the machine controller using the "SBus mode active" bit in the status word.

For safety reasons, you must also enable the frequency inverter at the terminals for control via the fieldbus system. Consequently, you must wire and program the terminals in such a way that the inverter is enabled via the input terminals. The simplest way of enabling the frequency inverter on the terminal side is to set the DIØØ input terminal (function CW/STOP) to a +24 V signal and to program the other input terminals to NO FUNCTION.

Configure the parameter *P881 SBus address* to values 1 ... 8 in ascending order.

SBus address 0 is used by the DFE24B gateway, and so cannot be used here.

Configure the parameter *P883 SBus timeout* to values 50 ... 200 ms.

6 EtherCAT Operating Characteristics

This section describes the basic characteristics of the drive inverter on EtherCAT with control via fixed PDO for fieldbus communication (motion control applications → Sec. 7).

6.1 Controlling the MOVIDRIVE® MDX61B drive inverter

The MOVIDRIVE® B drive inverter is controlled using the fixed PDO, which are 10 I/O words long. These process data words are mapped directly in the process image when using an EtherCAT master, which means they can be addressed directly by the control program.

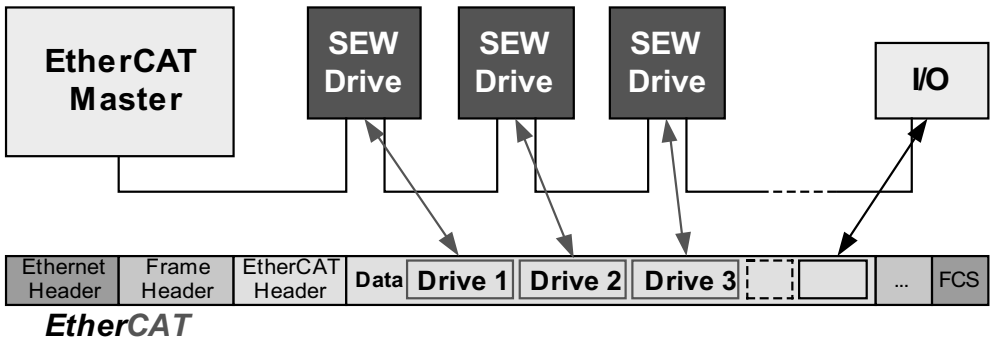

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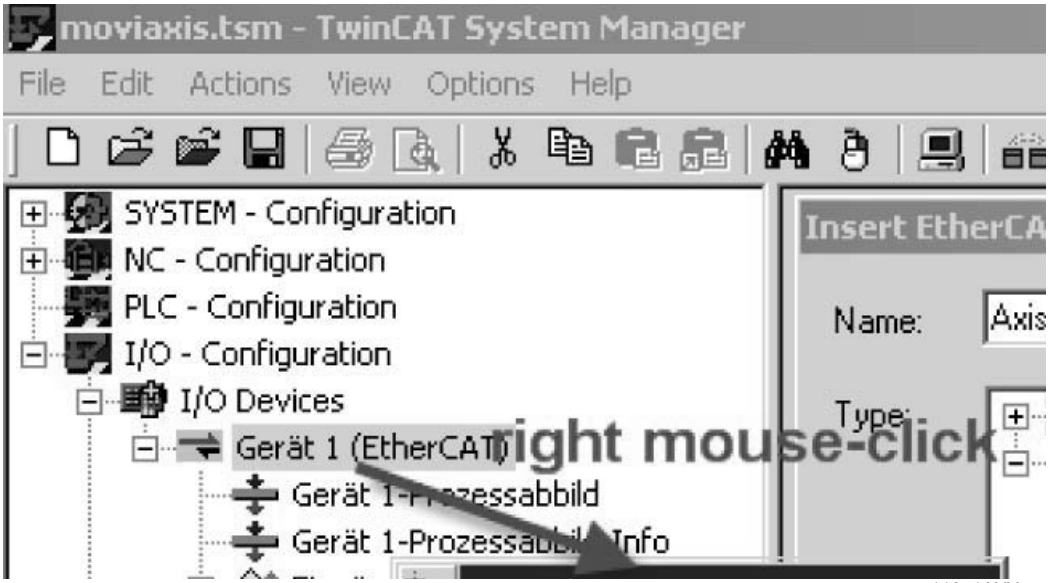
Figure 14: EtherCAT with SEW Drives

For more information on controlling via the process data channel, in particular the coding of the control and status words, refer to the "Fieldbus Unit Profile" manual.

6.1.1 Control example in TwinCAT with MOVIDRIVE® MDX61B

Once the *SEW_DFE24B.xml* file has been copied to the TwinCAT subdirectory "\IO\EtherCAT", you can use the function "Append box" to insert a MOVIDRIVE® B unit in the EtherCAT structure (→ following figure).



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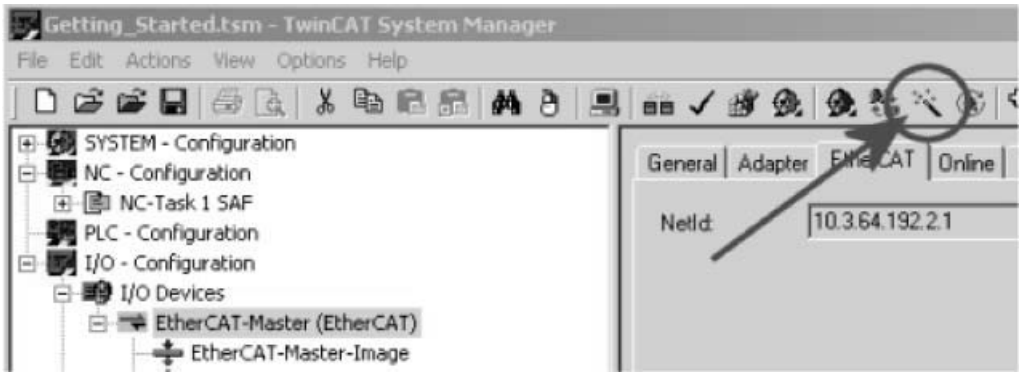
In "online mode" (i.e. when connected with the EtherCAT line), you can use the symbol "Find devices" to search the EtherCAT line for connected MOVIDRIVE® units (→ following figure).



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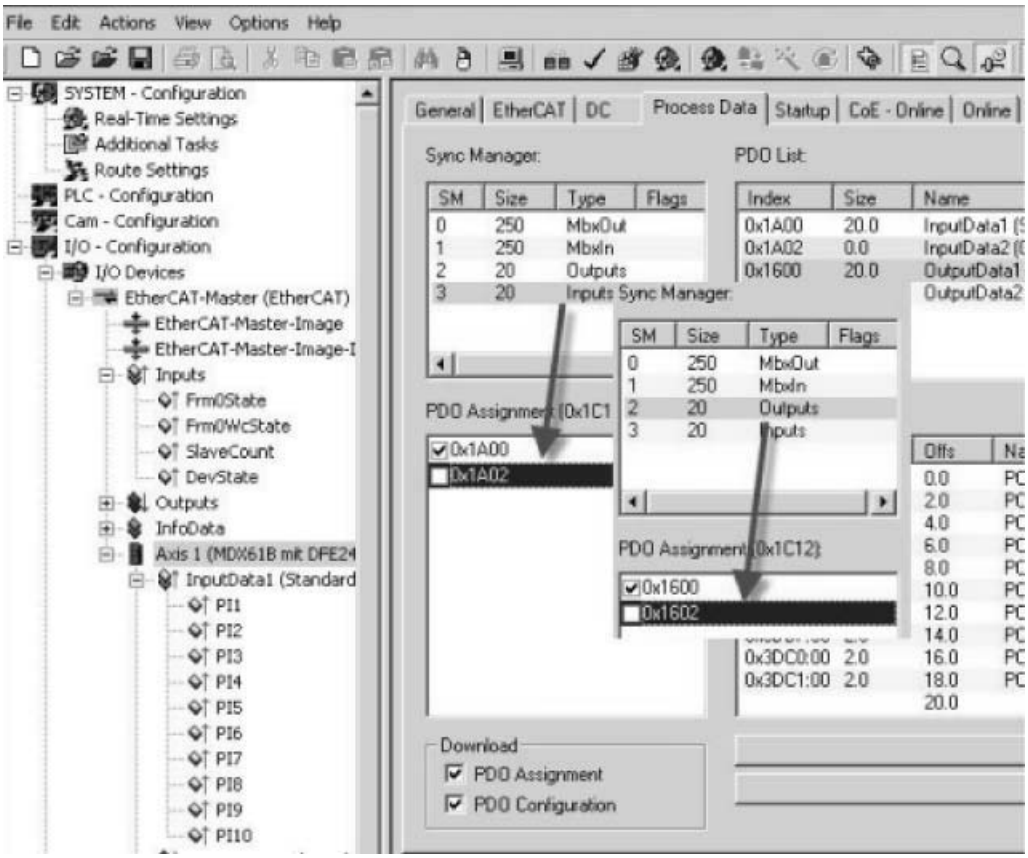
For simple fieldbus functionality, NC axes do not necessarily have to be created for each device that is found.

For the simplest form of process data transport, only the two PDOs *InputData1* and *OutputData1* are required. You can deactivate the configurable PDOs by deleting the marker for both PDOs (Input and Output) (→ following figure).



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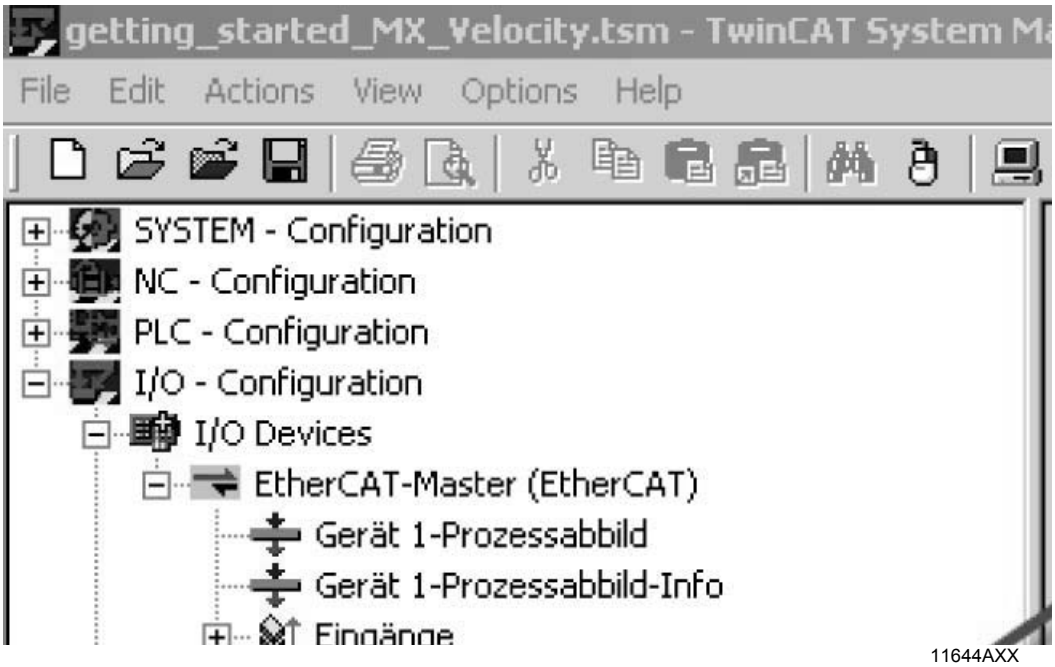
Now, you can either connect up to 10 process data words with the PLC program or - as shown in the following figure - write them for manual testing.



First select process output data PO1. In the window that appears, choose the tab page "Online". Click "Write". The "Set Value Dialog" window opens. Enter your data in the "Dec" or "Hex" field. Repeat the procedure for process output data PO2.

The 10 process input and output data words are assigned and scaled in MOVIDRIVE® B in the 87_ parameter group or defined via an IPOS$^{plus®}$ program or application module.

For more information, refer to the "MOVIDRIVE® MDX60B/61B" system manual and the "Fieldbus Unit Profile" manual.

6.1.2 EtherCAT timeout (MOVIDRIVE® MDX61B)

If data transfer via EtherCAT is disturbed or interrupted, the fieldbus monitoring time (standard value 100 ms) configured in the master elapses in MOVIDRIVE® MDX61B. The **DFE24B ERR** LED signals that no new user data can be received. At the same time, MOVIDRIVE® MDX61B performs the fault response selected with *P831 Fieldbus timeout response*.

P819 Fieldbus timeout displays the monitoring time specified by the master during the EtherCAT startup. The duration of the timeout can only be changed via the master. Modifications made using the keypad or MOVITOOLS® do not have any effect and are overwritten during the next startup of the PLC.

6.1.3 Fieldbus timeout response (MOVIDRIVE® MDX61B)

Parameter *P831 Fieldbus timeout delay* is used to set the fault response that is triggered via the fieldbus timeout monitoring function. The setting made here must match the configuration of the master system.

6.2 Controlling the MOVITRAC® B (Gateway) frequency inverter

The frequency inverters connected to the gateway are controlled via the process data channel, which is 3 I/O data words for each connected inverter. These process data words are mapped directly in the process image when using an EtherCAT master, which means they can be addressed immediately by the control program.

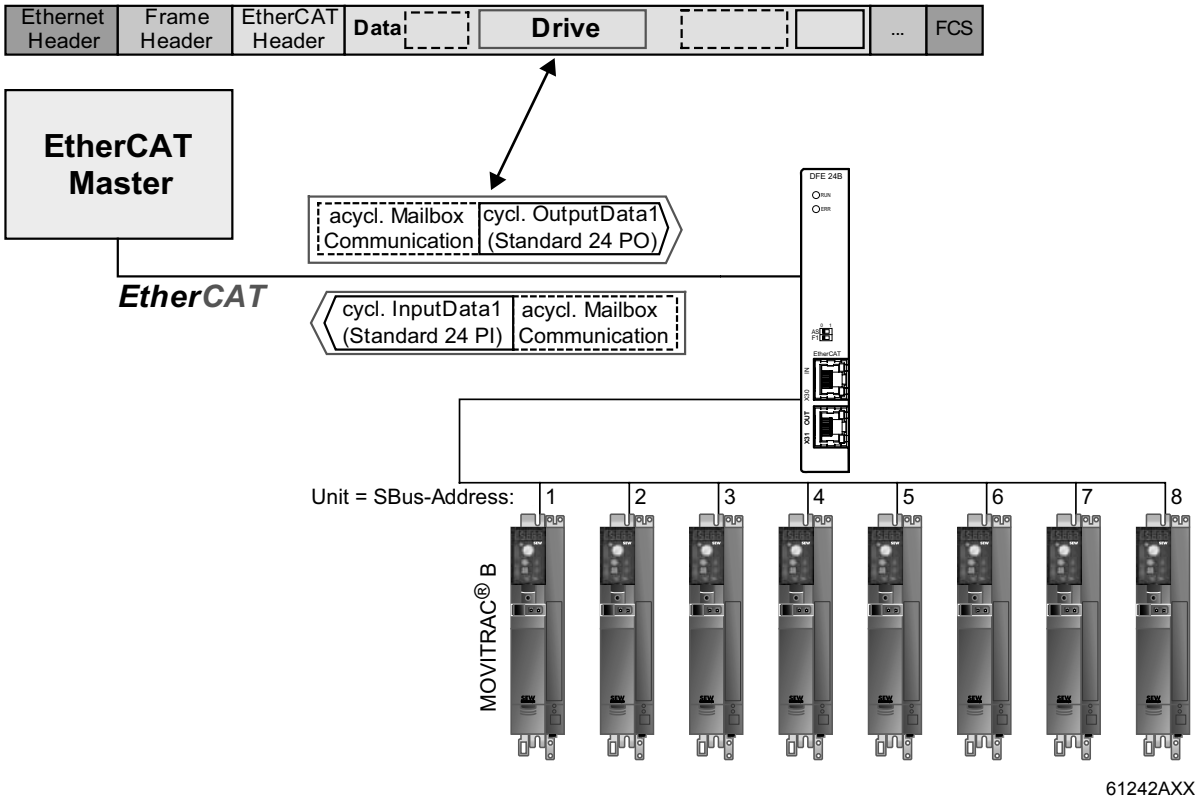


Figure 15: Mapping EtherCAT data in the PLC address range

PO = process output data / PI = process input data

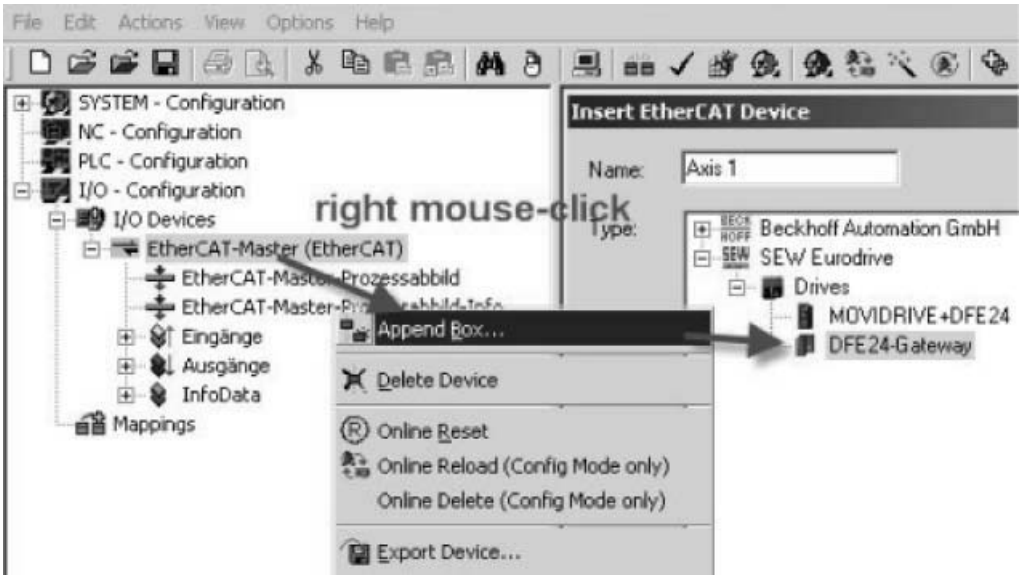
The 24 process input and output data words in the PDO are transmitted from the gateway to up to 8 inverters connected via SBus as follows:

- Words 1, 2 and 3 to the inverter with the lowest SBus address (e.g. 1)
- Words 4, 5 and 6 to the inverter with the next highest SBus address (e.g. 2)
- ....

If fewer than 8 frequency inverters are connected to the gateway, the upper words in the PDO have no significance - they are not transmitted to any inverter.

6.2.1 Control example in TwinCAT with MOVITRAC® B (gateway)

Once the *SEW_DFE24B.xml* file has been copied to the TwinCAT subdirectory "\IO\EtherCAT", you can use the function "Append box" to insert a DFE24B gateway in the EtherCAT structure (→ following figure).



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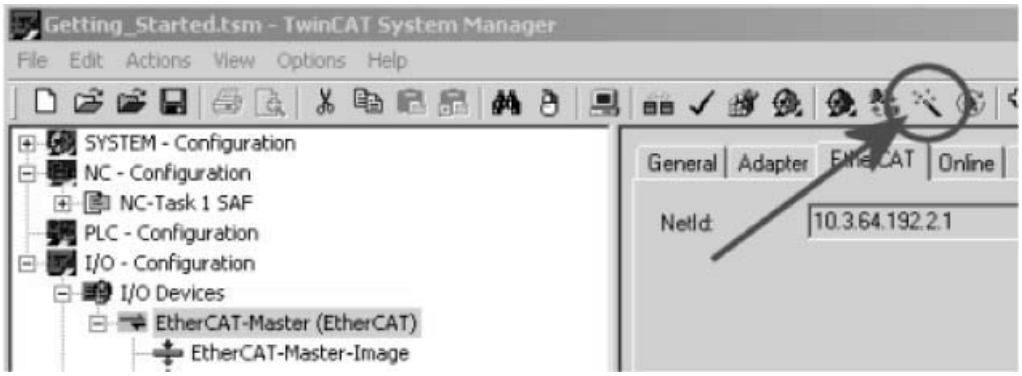
In "online mode" (i.e. when connected with the EtherCAT line), you can use the symbol "Find devices" to search the EtherCAT line for connected DFE24B gateways (→ following figure).



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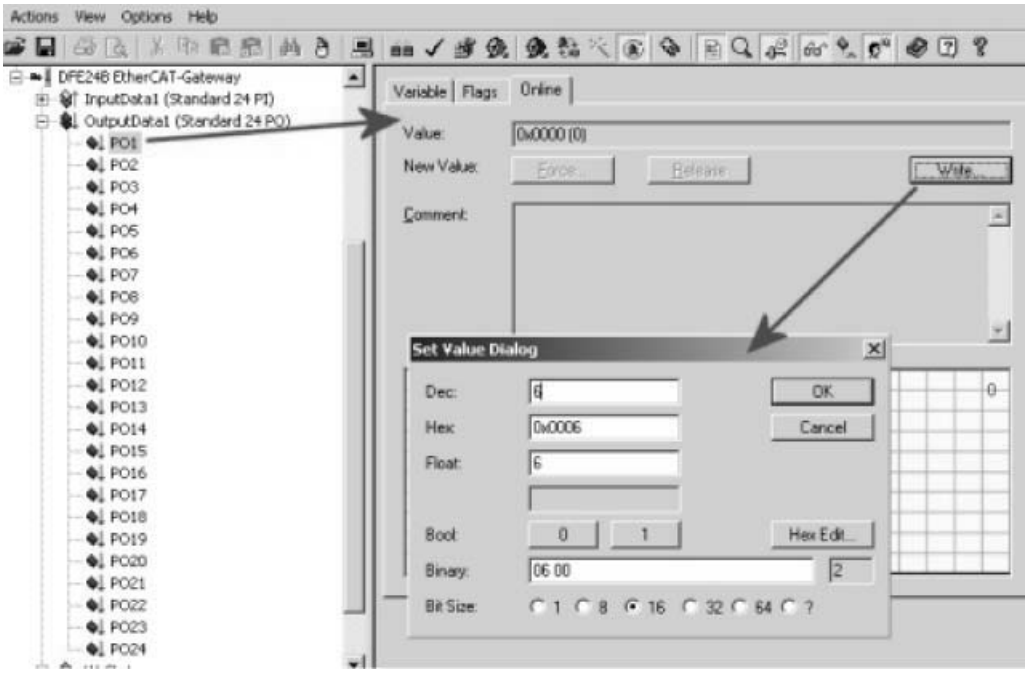
It is not a good idea to create an NC axis for each DFE24B gateway that is found. In this case, an axis would have to be created for every MOVITRAC® B inverter connected to the DFE24B gateway. For simple fieldbus functionality, NC axes do not necessarily have to be created for each device that is found.

The first 3 process data words are exchanged with the first MOVITRAC® B unit on the DFE24B gateway. They can be connected to the PLC program or written for manual testing (→ following figure).



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First select process output data PO1. In the window that appears, choose the tab page "Online". Click "Write". The "Set Value Dialog" window opens. Enter your data in the "Dec" or "Hex" field. Repeat the procedure for process output data PO2.

The 3 process input and output data words are assigned and scaled in MOVITRAC® B in the 87_ parameter group or defined via an IPOS$^{plus®}$ program. For more information, refer to the "MOVITRAC® B" system manual and the "MOVITRAC® Communication" manual.

6.2.2 SBus timeout

If one or several drive inverters on the SBus can no longer be addressed by the DFE24B, the gateway displays error code *F111 System error* on status word 1 of the respective drive inverter. LED **H1** (system fault) lights up. The fault is also displayed via diagnostics interface X24. The *SBus timeout time (P883)* of the MOVITRAC® B system error must be set to a value other than 0 for the drive inverter to stop. The timeout response can be defined via parameter P836.

6.2.3 Unit faults

Gateways detect a series of hardware defects automatically and lock out as a result. The exact error responses and remedies can be found in the list of errors. If an error occurs during a self-test, the fault *F111 System error* is displayed on the fieldbus process input data for status words 1 of all drive inverters. In this case, LED **H1** (system error) flashes at regular intervals on the DFE24B. The exact error code is displayed in the status of the gateway with MOVITOOLS® MotionStudio using diagnostics interface X24.

6.2.4 DFE24B fieldbus timeout in gateway operation

You can use the parameter *P831 Fieldbus timeout response* to set how the gateway should respond when EtherCAT communication times out.

P831 Fieldbus timeout response	Description
No response	The drives connected via SBus continue to work with the last setpoint. The drives cannot be controlled any longer when EtherCAT communication is interrupted.
PO_DATA = 0	When an EtherCAT timeout is detected, a rapid stop is activated for all drives that have process data configuration with control word 1 or 2. To do so, the gateway sets bits 0 ... 2 of the control word to 0. The drives are brought to a standstill using the rapid stop ramp.

6.3 Configuration via EtherCAT

With EtherCAT, the drive parameters are accessed via the standard SDO READ and WRITE services in CoE (CANopen over EtherCAT).

Inverter configuration using the EtherCAT parameter channel is only possible for MOVIDRIVE® MDX61B and the parameters of the DFE24B gateway.

At present, the EtherCAT SDO parameter channel does not enable access to parameters on inverters connected via SBus to the gateway.

Via VoE (Vendor-specific over EtherCAT), MOVITOOLS® MotionStudio can **also** access MOVITRAC® B inverters connected to the gateway via SBus (→ Sec. 8).

6.3.1 SDO READ and WRITE services

The user interface is displayed differently depending on the EtherCAT master or configuration environment. However, the following parameters are always required to execute the SDO command.

SDO-READ	Description
Slave address (16 bit)	EtherCAT address of the inverter from which data is to be read.
Index (16 bit) Subindex (8 bit)	Address in the object dictionary that is to be read.
Data Data length	Structure to store received data and its length.

SDO-WRITE	Description
Slave address (16 bit)	EtherCAT address of the inverter to which data is to be written.
Index (16 bit) Subindex (8 bit)	Address in the object dictionary that is to be written.
Data Data length	Structure in which the data to be written is stored.

Additional flags and parameters may also be required for the READ and WRITE SDO services:

- to activate the function
- to display in-process messages or error messages
- to monitor timeout times
- to report errors in the execution

6.3.2 Example of reading a parameter in TwinCAT via EtherCAT

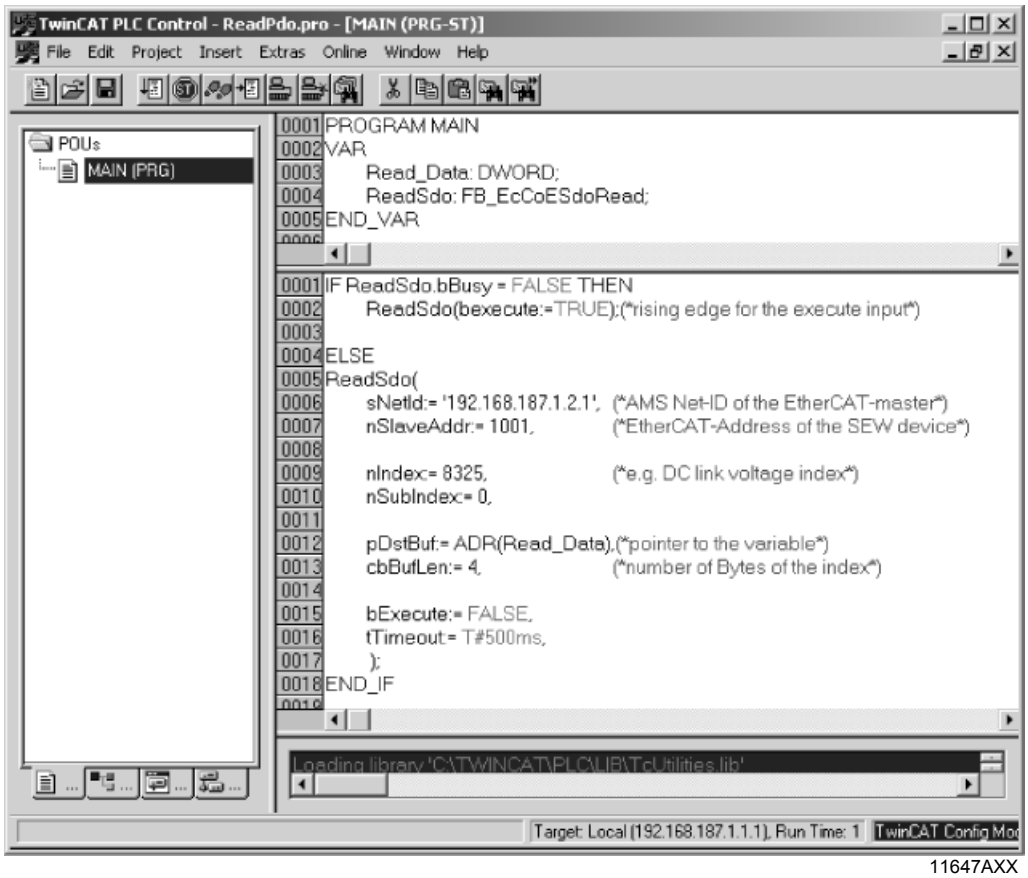
The function SDO-READ is available for reading parameters. The index of the parameter to be read is required. You can display the parameter index in the SHELL program or in the parameter tree using the key combination [CTRL + F1].

The function module *FB_EcCoESdoRead* is required for implementation in TwinCAT. This function module is included in the *TcEtherCAT.lib* library. This function module can be integrated in two steps.

1. Create an instance of the *FB_EcCoESdoRead* function module
2. The inputs of the function modules are assigned as follows:
   - sNetID: Net ID of the EtherCAT master
   - nSlaveAddr: EtherCAT address of the SEW device from which data is to be read.
   - nIndex: Index of the parameter to be read.
   - nSubIndex: Subindex of the parameter to be read.
   - pDstBuf: Pointer to the data range in which the read parameter is to be stored.
   - cbBufLen: Maximum memory size in bytes for the parameter that is to be read.
   - bExecute: A positive edge starts the reading process.
   - tTimeout: Timeout time of the function module.

The output flags *bBusy* and *bError* indicate the status of the service. *nErrId* shows the error number when the *bError* flag is set if an error occurs.

The figure below shows the process of integrating the function module in TwinCAT:



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SEW parameters always have a data length of 4 bytes (1 DWord). Refer to the "Fieldbus Unit Profile" manual for more details and information on scaling.

In the above example, the DC link voltage was read (index 8325, subindex 0). For example, the value 639000 is received, which - according to the fieldbus unit profile - corresponds to a voltage of 639 V.

6.3.3 Example of writing a parameter in TwinCAT via EtherCAT

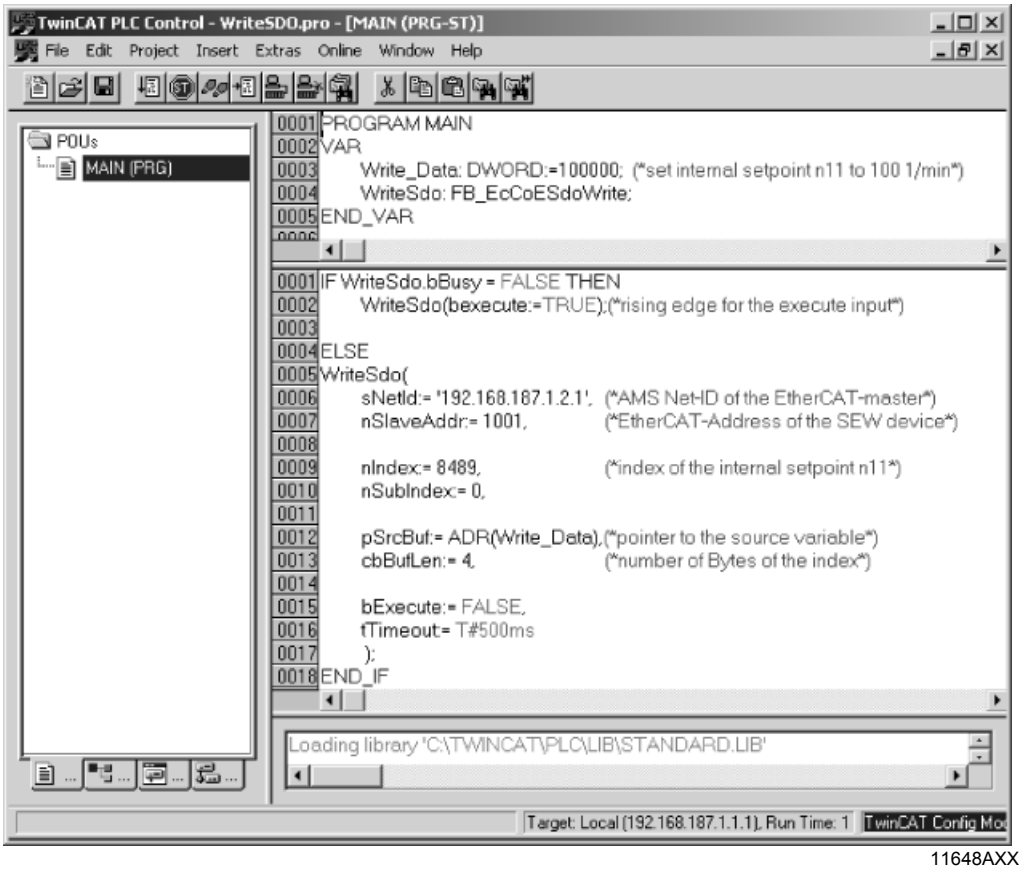
The function SDO-WRITE is available for writing parameters. The index of the parameter to be written is required. You can display the parameter index in the SHELL program or in the parameter tree using the key combination [CTRL + F1].

The function module *FB_EcCoESdoWrite* is required for implementation in TwinCAT. This function module is included in the *TcEtherCAT.lib* library. This function module can be integrated in two steps.

1. Create an instance of the *FB_EcCoESdoWrite* function module
2. The inputs of the function modules are assigned as follows:
   - sNetID: Net ID of the EtherCAT master
   - nSlaveAddr: EtherCAT address of the SEW device from which data is to be written.
   - nIndex: Index of the parameter to be written.
   - nSubIndex: Subindex of the parameter to be written.
   - pDstBuf: Pointer to the data range in which the data to be written is located.
   - cbBufLen: Amount of data to be sent, in bytes.
   - bExecute: A positive edge starts the writing process.
   - tTimeout: Timeout time of the function module.

The output flags *bBusy* and *bError* indicate the status of the service. *nErrId* shows the error number when the *bError* flag is set if an error occurs.

The figure below shows the process of integrating the function module in TwinCAT:



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SEW parameters always have a data length of 4 bytes (1 DWord). Refer to the "Fieldbus Unit Profile" manual for more details and information on scaling.

In the above example, the internal setpoint n11 (index 8489, subindex 0) was set to a speed of 100 rpm. In accordance with the fieldbus unit profile, the required speed must be multiplied by a factor of 1000.

6.4 Configuration return codes

6.4.1 Elements

In the event of incorrect parameter service, the drive inverter sends back various return codes to the master that sent the message. These codes provide detailed information about what caused the error. Generally, these return codes are structured into the following elements:

- Error class
- Error code
- Additional code

6.4.2 Error class

The error class element (1 byte) provides a more exact classification of the error type.

Class (hex)	Designation	Meaning
1	vfd state	Status error of the virtual field device
2	application reference	Error in application program
3	definition	Definition error
4	resource	Resource error
5	service	Error during execution of service
6	access	Access error
7	ov	Error in the object list
8	other	Other error

6.4.3 Error code

The error code element (1 byte) provides a means of more precisely identifying the cause of the error within the error class For *Error class 8 = Other error*, only *Error code = 0 (Other error code)* is defined. In this case, detailed identification is made using the *additional code*.

6.4.4 Additional code

The additional code (2 bytes) contains a detailed description of the error.

6.4.5 List of the error codes for SDO services

Error code	Error class	Error code	Additional code	Designation	Description
0x00000000	0	0	0	NO_ERROR	No error.
0x05030000	5	3	0	TOGGLE_BIT_NOT_CHANGED	Error in toggle bit during segmented transfer.
0x05040000	5	4	0	SDO_PROTOCOL_TIMEOUT	Timeout in the service execution.
0x05040001	5	4	1	COMMAND_SPECIFIER_UNKNOWN	Unknown SDO service.
0x05040005	5	4	5	OUT_OF_MEMORY	Memory overflow during SDO service execution.
0x06010000	6	1	0	UNSUPPORTED_ACCESS	Unauthorized access to an index.
0x06010001	6	1	1	WRITE_ONLY_ENTRY	The index can be written but not read.
0x06010002	6	1	2	READ_ONLY_ENTRY	Index can be read but not written. Parameter lock is active.
0x06020000	6	2	0	OBJECT_NOT_EXISTING	Object does not exist; incorrect index. An option card is not available for this index.
0x06040041	6	4	41	OBJECT_CANT_BE_PDOMAPPED	Index cannot be mapped in a PDO.
0x06040042	6	4	42	MAPPED_OBJECTS_EXCEED_PDO	Too many mapped objects for PDO.
0x06040043	6	4	43	PARAM_IS_INCOMPATIBLE	Incompatible data format for index.
0x06040047	6	4	47	INTERNAL_DEVICE_INCOMPATIBILITY	Internal device error.
0x06060000	6	6	0	HARDWARE ERROR	Internal device error.
0x06070010	6	7	10	PARAM_LENGTH_ERROR	Data format for the index is the wrong size.
0x06070012	6	7	12	PARAM_LENGTH_TOO_LONG	Data format for the index is too long.
0x06070013	6	7	13	PARAM_LENGTH_TOO_SHORT	Data format for the index is too short.
0x06090011	6	9	11	SUBINDEX_NOT_EXISTING	Subindex has not been implemented.
0x06090030	6	9	30	VALUE_EXCEEDED	Invalid value.
0x06090031	6	9	31	VALUE_TOO_GREAT	Value too high.
0x06090032	6	9	32	VALUE_TOO_SMALL	Value too low.
0x06090036	6	9	36	MAX_VALUE_IS_LESS_THAN_MIN_VALUE	Upper limit for the value is smaller than the lower limit.
0x08000000	8	0	0	GENERAL_ERROR	General error.
0x08000020	8	0	20	DATA_CANNOT_BE_READ_OR_STORED	Data access error
0x08000021	8	0	21	DATA_CANNOT_BE_READ_OR_STORED_BECAUSE_OF_LOCAL_CONTROL	Data access error due to local control.
0x08000022	8	0	22	DATA_CANNOT_BE_READ_OR_STORED_IN_THIS_STATE	Data access error due to unit state.
0x08000023	8	0	23	NO_OBJECT_DICTIONARY_IS_PRESENT	There is no object dictionary.

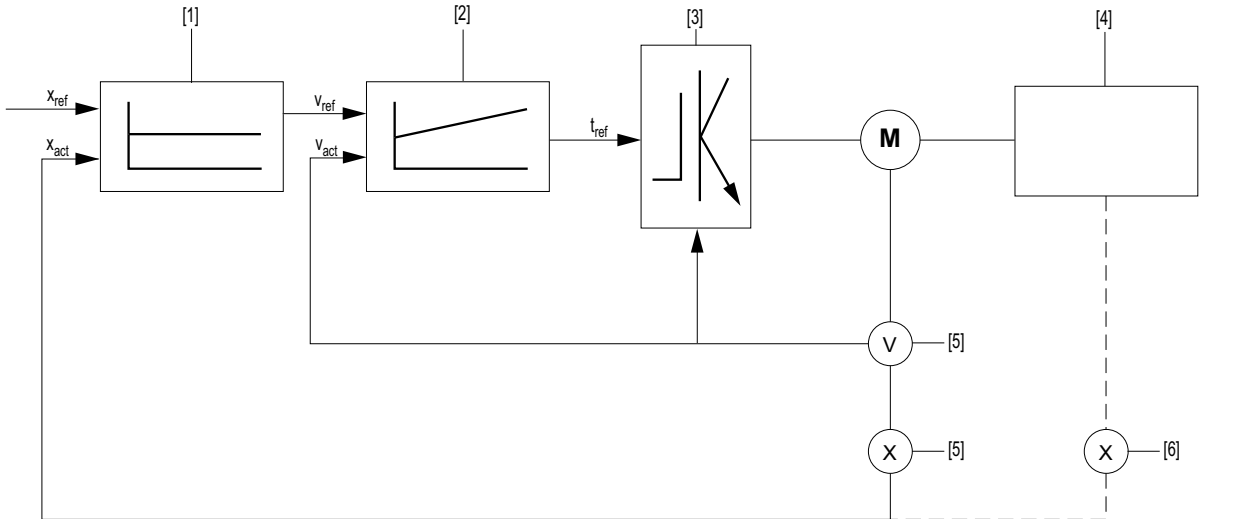
7 Motion Control via EtherCAT

This section contains information on the EtherCAT functions that enable MOVIDRIVE® B to be operated synchronously on an EtherCAT master for motion control applications.

7.1 Introduction to EtherCAT

This section describes the functions and terms used for running SEW drive inverters on EtherCAT in synchronous operation. More technical and comprehensive information on EtherCAT is available from the EtherCAT User Organization at www.EtherCAT.org and from the manufacturers of EtherCAT master systems.

The following section describes the basic mechanisms required for motion control applications, starting with cascade control, a typical feature of drive engineering.



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x_{ref}	Position setpoint	[1]	Position controller
x_{act}	Actual position value	[2]	Speed controller
v_{ref}	Speed setpoint	[3]	Output stage of the inverter
v_{act}	Actual speed value	[4]	Drive machine (load)
t_{ref}	Torque setpoint	[5]	Encoder (V = speed; X = position)

The process starts with a position setpoint (x_{ref}). Using this and the actual position value (x_{act}), the position controller [1] calculates a speed setpoint (v_{ref}). The speed controller [2] uses this speed setpoint and actual speed value v_{act} to calculate the torque setpoint (t_{ref}) to create torque in the motor powered by the inverter [3]. A speed (measured using encoder [5]) occurs in the motor depending on the counter-torque of the driven machine [4]. A position change measured using the position sensors [5] or [6] results depending on the motor speed.

Depending on the application, control loops for torque, speed or position can be closed in the inverter or in a higher-level controller. MOVIDRIVE® B can handle all control loops, including position control. In this way, positioning travel can only be executed on the inverter by specifying a setpoint position (e.g. application module "Bus Positioning"). The current position and - when the positioning task is completed - a "ready message" is sent to the controller.

In motion control applications, positioning travel with target position and travel parameters, such as speed and ramp times, is calculated in the motion controller, i.e. usually the higher-level controller. The calculated track curve is then used to transfer a setpoint speed (→ Sec. 7.1.1 "Velocity mode") or a setpoint position (→ Sec. 7.1.2 "Position mode") to the inverter in very quick cycles. The inverter follows this setpoint speed or position and returns the current position. The motion controller itself knows when the positioning task is completed.

The motion controller cyclically transfers the setpoints that are calculated factoring in also the given speed ramps. Drive internal ramp functions are bypassed.

Synchronization

The controller reads in the actual position value in each control cycle and calculates the actual speed from the position difference (dx) and the time difference (dt) of the last control interval (dx/dt). If necessary, additional values such as acceleration and jerk are also calculated from dx and dt values.

For this purpose, the control time-slices of the controller, the bus transfer, the internal processing cycle of the inverter and, if necessary, external encoders, must be synchronized.

Example

This example shows how aliasing effects occurs if controller, bus, inverter or encoder, do not operate synchronously (→ following figure).

- Control time-slice of the controller: 5 ms
- Bus cycle: 5 ms, in synch with the controller
- Processing time in the inverter: 5 ms, not in synch

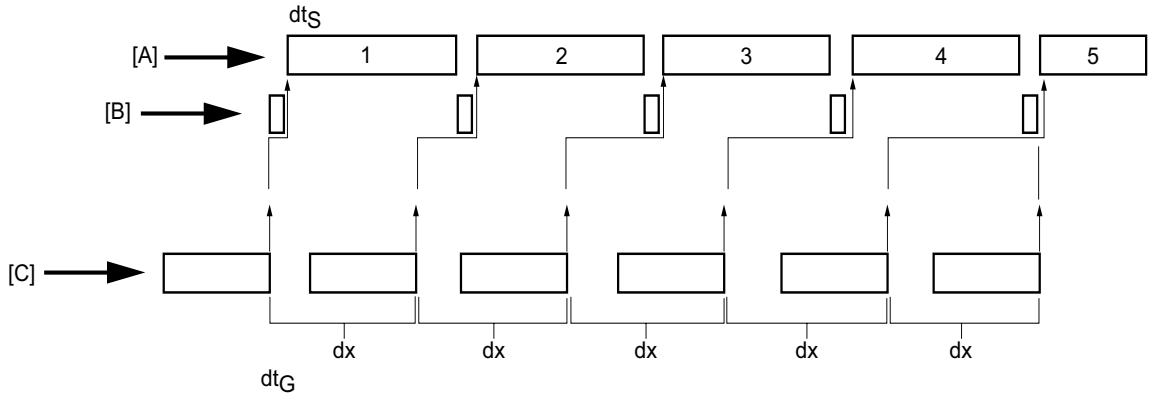

Figure 16: Aliasing

[A]	Control interval dt_S	[C]	Inverter of encoder time-slice dt_G
[B]	Bus cycle	dx	Position difference (distance covered)

As the inverter or encoder and controller are not synchronized in this example, the quartz oscillators in both units - which are not ideal - cause the time-slices to drift slowly past one another. This causes discontinuity in the transferred position value.

Whereas the speed ($v = dx/dt_S \approx dx/dt_G$) in control intervals 1 to 3 is only slightly inaccurate, there is considerable error in the speed calculation in the fourth control interval (v = 2dx/dtS). An inaccurate speed value of this magnitude in one interval can cause strong responses in the controller's control algorithms and can even trigger error messages.

The problem described above, that results from discrete scanning in different systems, usually only causes problems in motion control applications when the cycle time in the controller is short or when it occurs on the same scale as the internal processing cycle of the inverter and external encoder.

EtherCAT is designed so that the bus and control cycle operate synchronously.

The *Distributed Clock* mechanism also makes sure that the internal processing time-slice of the inverter is synchronized to the controller too.

In MOVIDRIVE® B, the time-slices and data transfers are synchronized via the dual-port RAM of option DFE24B

7.1.1 Velocity mode

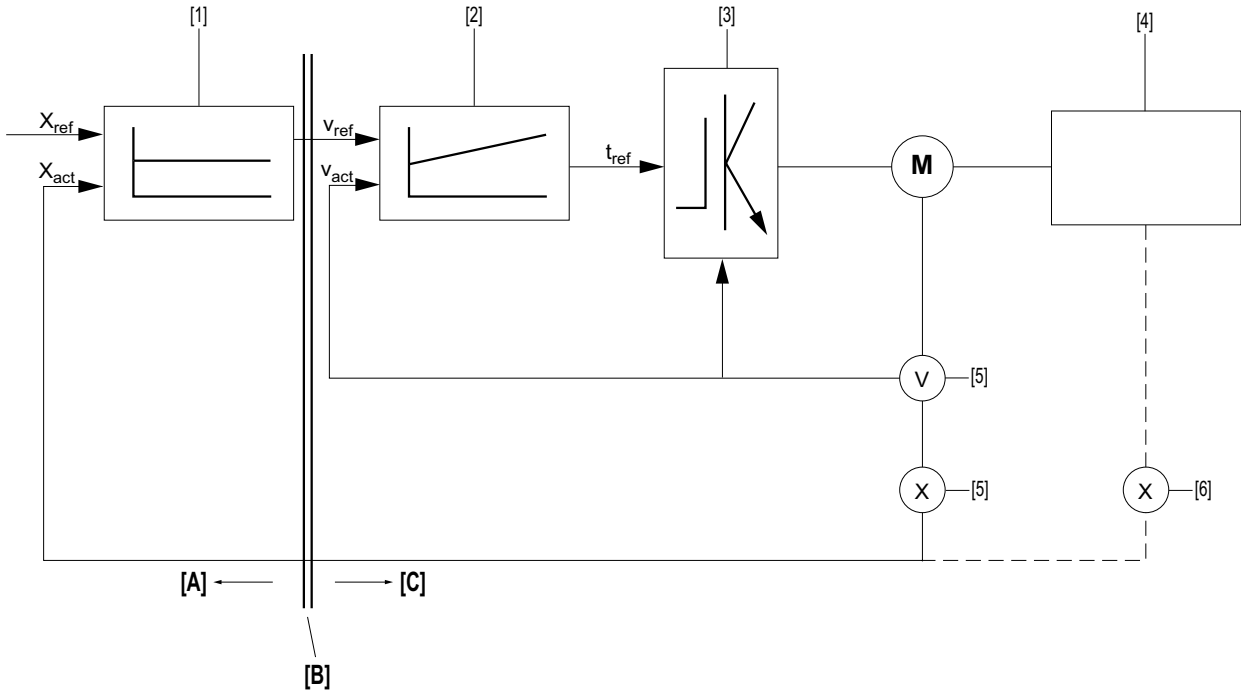

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Figure 17: Velocity mode – cascade with fieldbus interface

[A]	Control	[B]	Fieldbus interface	[C]	Inverter

x_{ref}	Position setpoint	[1]	Position controller
x_{act}	Actual position value	[2]	Speed controller
v_{ref}	Speed setpoint	[3]	Output stage of the inverter
v_{act}	Actual speed value	[4]	Driven machine
t_{ref}	Torque setpoint	[5]	Encoder (V = speed; X = position)
		[6]	Optional synchronous encoder

In velocity mode, a speed (or velocity) setpoint is transferred from the controller to the inverter and the actual position value is read back from the inverter or a separate position sensor.

In velocity mode, the inverter is a simple speed actuator. The control time-slices of the controller, bus transfer, the internal processing cycle of the inverter and the encoder must be synchronized.

Position referencing, monitoring of permitted travel ranges or limit switches, load-dependent ramp specification, and lag error monitoring are realized in the higher-level controller, not in MOVIDRIVE® B.

To prevent unwanted excessive acceleration during longer control intervals (>1 ms), instead of adopting the speed setpoint directly, MOVIDRIVE® B uses linear interpolation. This means that for a setpoint cycle of 5 ms, the controller in MOVIDRIVE® B does not activate the required speed change every 5 ms in a single step, but rather in 5 small steps of 1 ms each.

7.1.2 Position mode

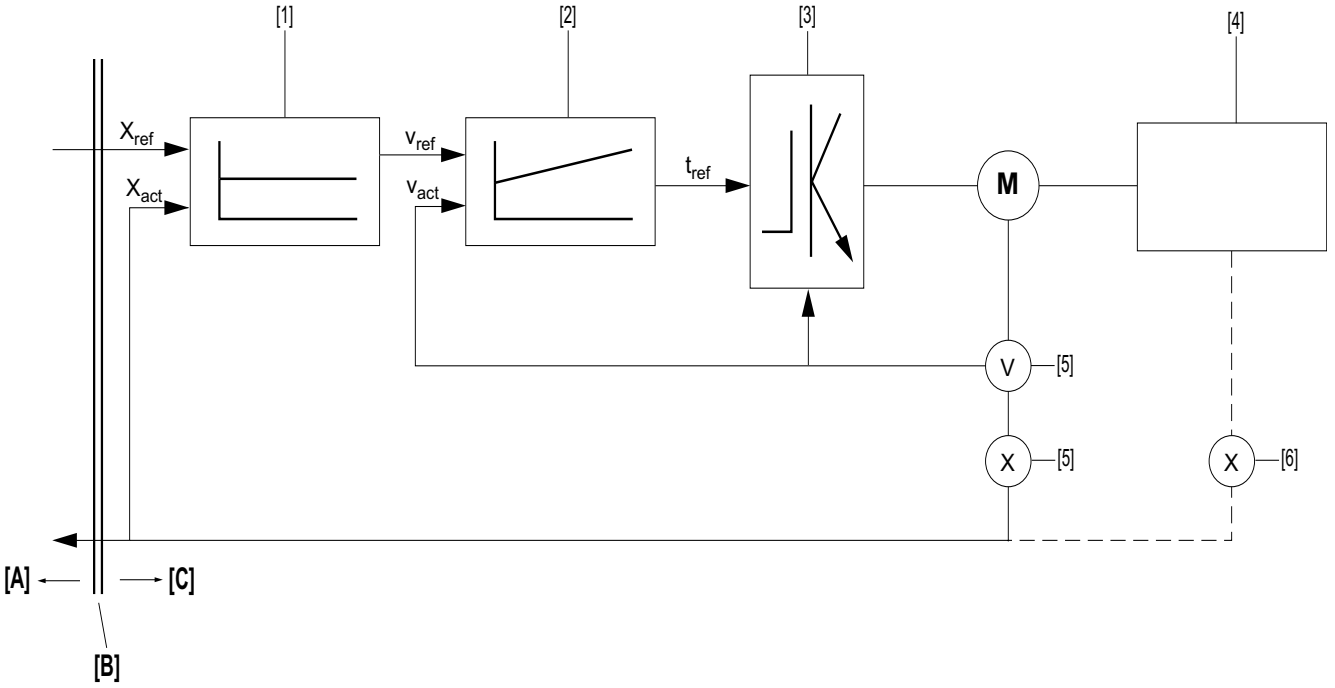

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Figure 18: Position mode – cascade with bus interface

[A]	Control	[B]	Fieldbus interface	[C]	Inverter
x_{ref}	Position setpoint	[1]	Position controller		
x_{act}	Actual position value	[2]	Speed controller		
v_{ref}	Speed setpoint	[3]	Output stage of the inverter		
v_{act}	Actual speed value	[4]	Driven machine		
t_{ref}	Torque setpoint	[5]	Encoder (V = speed; X = position)		
		[6]	Optional synchronous encoder		

In position mode, a position setpoint is transferred cyclically from the controller to the inverter and the actual position value is returned by the inverter or the separate position sensor.

In position mode, the inverter follows the changing position setpoint and generates the required speed setpoint for the speed controller [2] itself out of the actual position x_{act} from [5] or [6]. The control time-slices of the controller, bus transfer, the internal processing cycles of the inverter and the encoder must be synchronized.

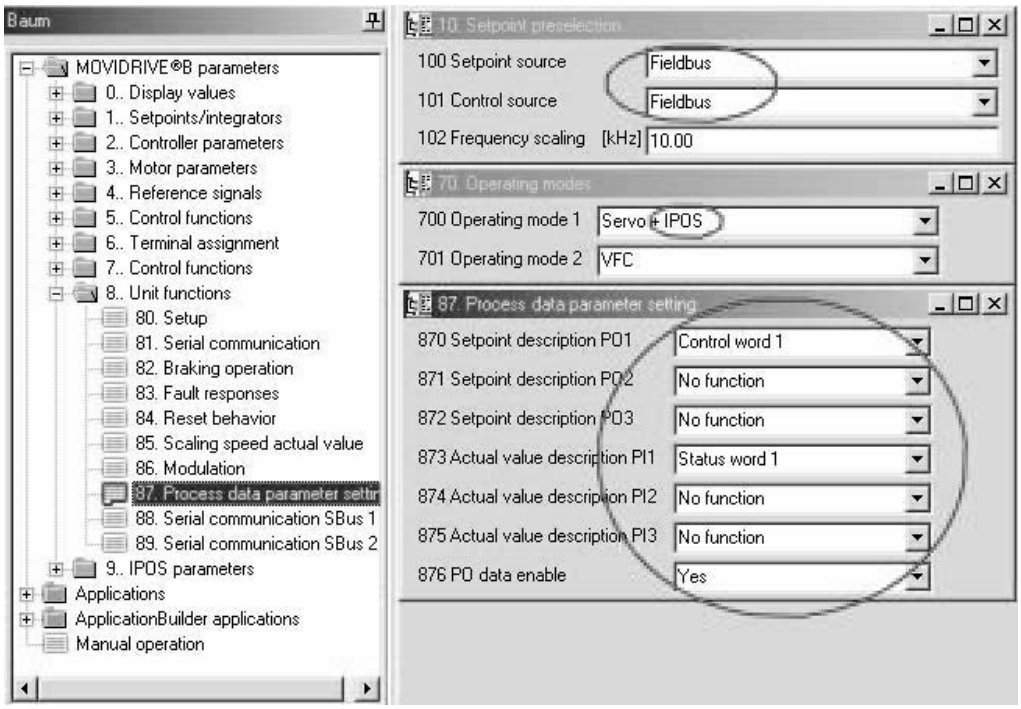
Once the position in the controller has been referenced to the position in the inverter, permitted travel ranges or limit switches can be monitored in the inverter. You must check carefully whether the settings for the load-dependent ramp specification and lag error monitoring in the inverter are plausible.

To prevent unwanted excessive acceleration during longer control intervals (>1 ms), instead of adopting the position setpoint directly, MOVIDRIVE® B uses linear interpolation. This means that for a setpoint cycle of 5 ms, the controller in MOVIDRIVE® B does not activate the required position change every 5 ms in a single step, but rather in 5 small steps of 1 ms each.

7.2 Settings in MOVIDRIVE® B with MOVITOOLS® MotionStudio

7.2.1 Settings for velocity mode

You must make the following parameter settings in MOVITOOLS® MotionStudio to control a MOVIDRIVE® B unit in motion control with synchronized speed setpoints (→ following figure):



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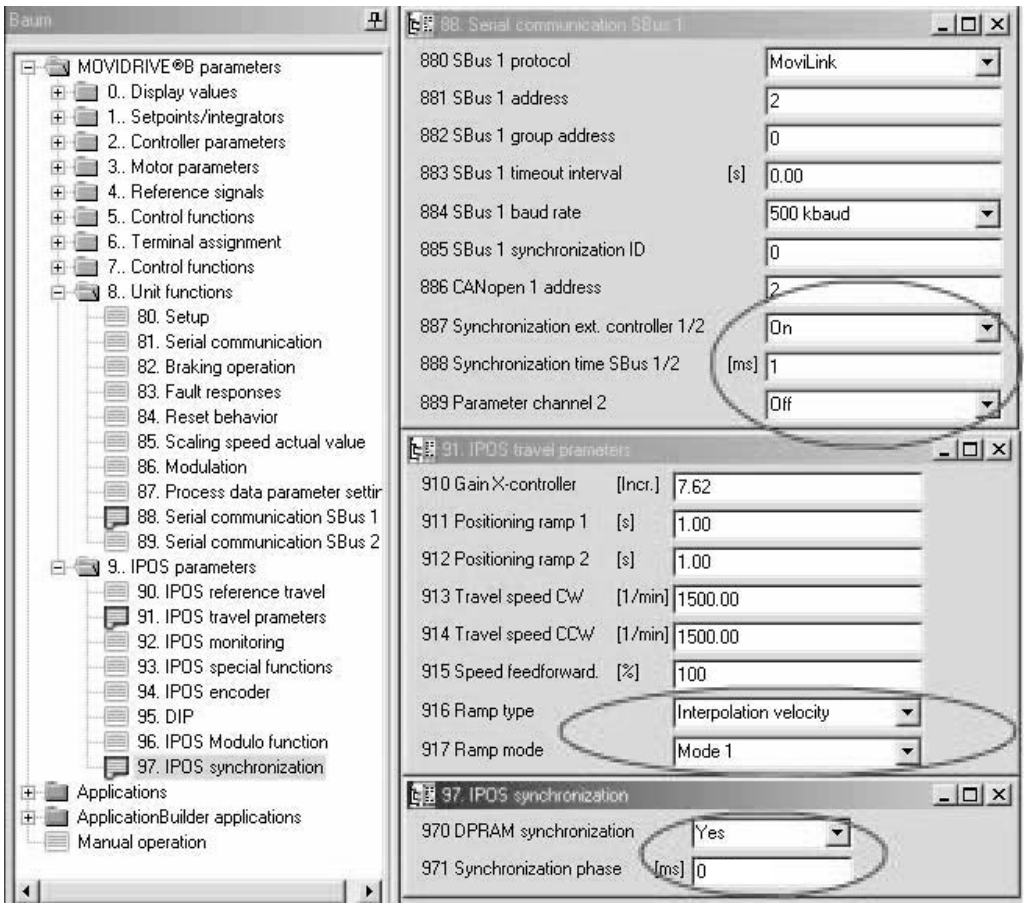
- P100 Setpoint source = Fieldbus
- P101 Control signal source = Fieldbus
- P700 Operating mode = SERVO + IPOS or CFC + IPOS
- P870 Setpoint description PO1 = Control word 1
- P873 Actual value description PI1 = Status word 1

Next, activate controller synchronization in the EtherCAT network. To do so, make the following parameter settings (→ following figure):



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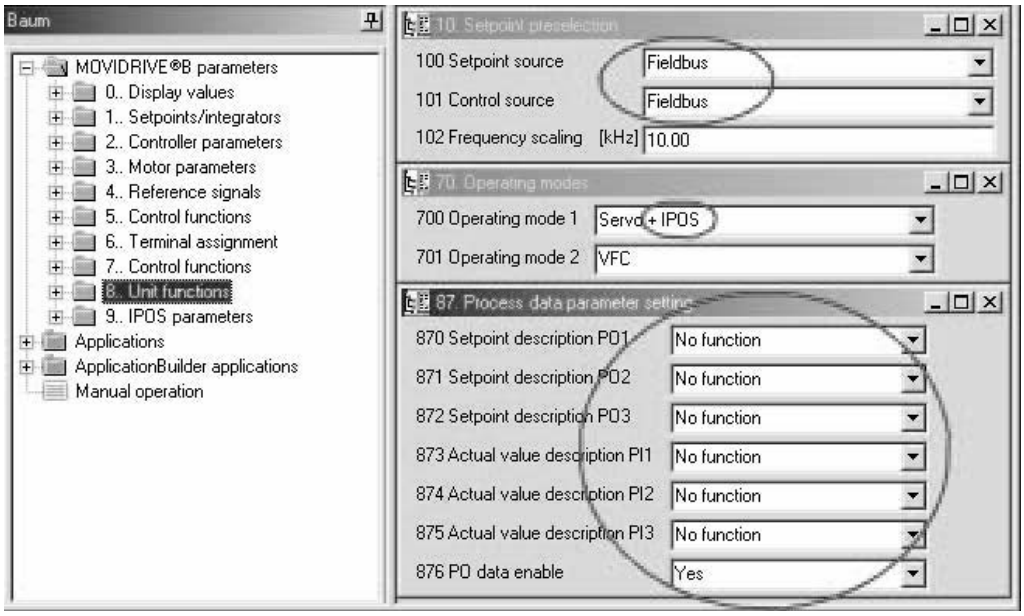
- P887 Synchronization ext. controller = ON
- P888 Synchronization time SBus [ms] = 1

  The synchronization time must correspond exactly with the bus cycle.
- P916 Ramp type = Interpolation velocity
- P970 DPRAM Synchronization = YES
- P971 Synchronization phase = 0

  P971 can be used to optimize the synchronization phase if aliasing occurs. Set a sycn phase of 0 ms as standard.

7.2.2 Settings for position mode

You must make the following parameter settings in MOVITOOLS® MotionStudio to control a MOVIDRIVE® B unit in motion control with synchronous position specification (→ following figure):



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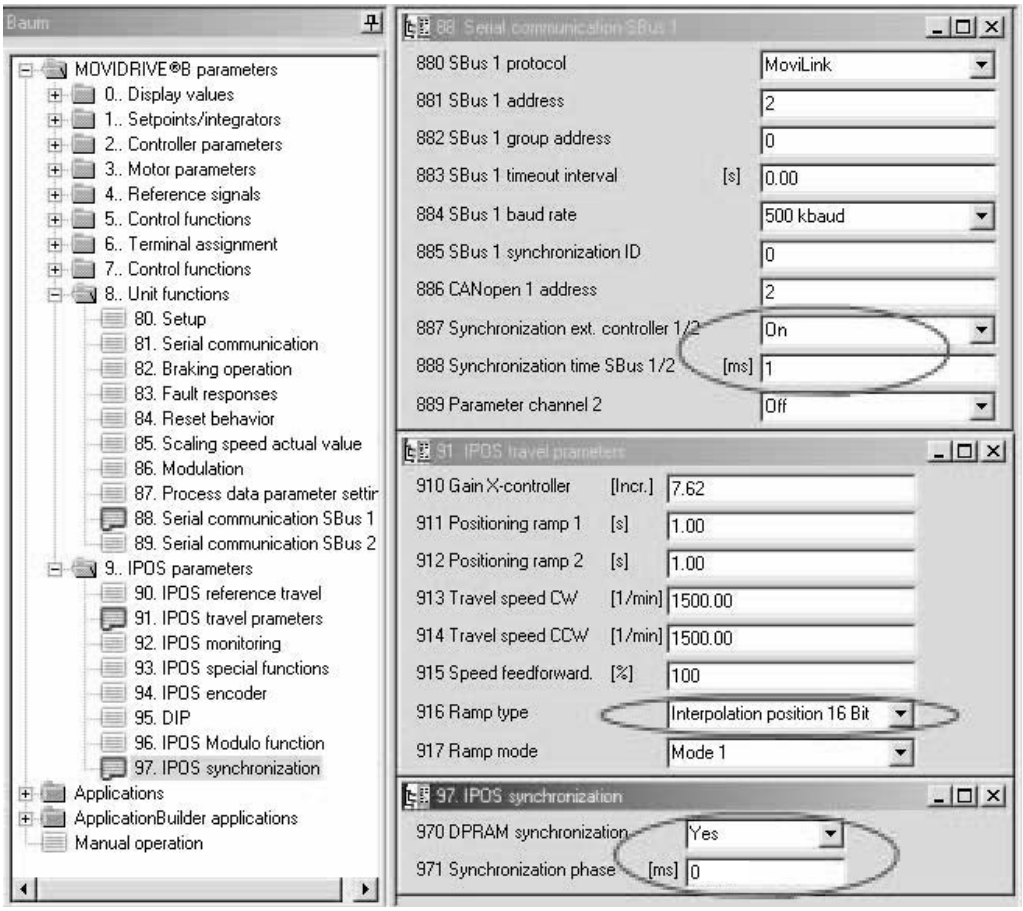
- P100 Setpoint source = Fieldbus
- P101 Control signal source = Fieldbus
- P700 Operating mode = SERVO + IPOS or CFC + IPOS
- P87x Process data description

  The control word and status word can be used depending on the controller and application. The control and status words can be set using parameters P870 ... P876 or transferred to IPOS$^{plus®}$ variables and activated in accordance with the functions of the status machine of the motion controller.

Next, activate controller synchronization in the EtherCAT network. To do so, make the following parameter settings (→ following figure):



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- P887 Synchronization ext. controller = ON
- P888 Synchronization time SBus [ms] = 1

  The synchronization time must correspond exactly with the bus cycle.
- P916 Ramp type = Interpolation position 16 Bit
- P970 DPRAM Synchronization = YES
- P971 Synchronization phase = 0

  P971 can be used to optimize the sync phase if aliasing occurs. Set a sync phase of 0 ms as standard.

7.3 Settings in EtherCAT master

Activate the *Distributed Clock* function for time-slice synchronization. The bus cycle must correspond exactly with the synchronization time set in parameter P888. You should also activate the watchdog for timeout monitoring for the Sync Manager 0x1000 (Output Data) only.

Make sure you deactivate the fixed PDO (*InputData1* and *OutputData1*).

7.3.1 Settings for velocity mode

- The speed setpoint is written directly to system variable H499 via the configured PDO2 and is scaled as follows:
  - 1 digit ≙ 0.2 rpm, that is, a value of 5000 ≙ rpm

  The parameters used in the controller must be scaled before they are transferred to the inverter.

- The control word is transferred via PDO1 together with the speed setpoint in PDO2.

- The position that is transferred to the controller is read directly from system variable H511 via the configurable PDO2. The position is scaled as follows:
  - 4096 digits represent one revolution of the motor shaft

  The position that is read in must then be scaled to the parameters used in the controller.

- The status word is transferred via PI1 together with the actual position value in PDO2.

7.3.2 Settings for position mode

- The position setpoint is written directly to system variable H499 via the configured PDO2 and is scaled as follows:
  - 1 revolution of the motor shaft $\triangleq 2^{16}$

  The parameters used in the controller must be scaled accordingly before they are transferred to the inverter.

- The control word can be transferred as follows:
  - Via PO1 together with the position setpoint in PDO2
  - Directly to a system variable in IPOS$^{plus®}$ if the status machine has to be optimized. The application-specific adjustment of the status machine is then executed as an IPOS$^{plus®}$ program or a PLC program in the motion controller.

- The position that is transferred to the controller is read directly from system variable H508 via the configurable PDO2. The position is scaled as follows:
  - 1 revolution of the motor shaft = 2^{16}

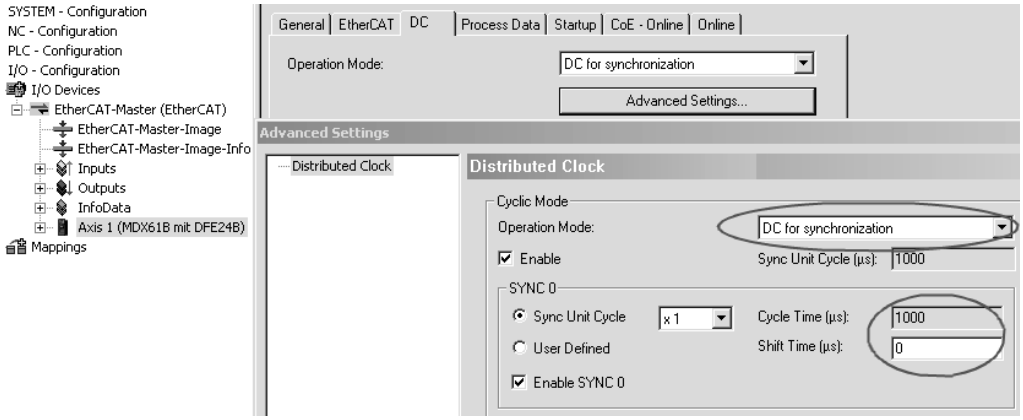
  The position that is read in must then be scaled to the parameters used in the controller.

- The status word can either be transferred via PI1 together with the position setpoint in PDO2, or - if the status machine is adapted for a particular application in IPOS$^{plus®}$ - read in directly from a system variable in IPOS$^{plus®}$.

7.4 Example in TwinCAT

Configure synchronous operation

Make the settings shown in the following figures.



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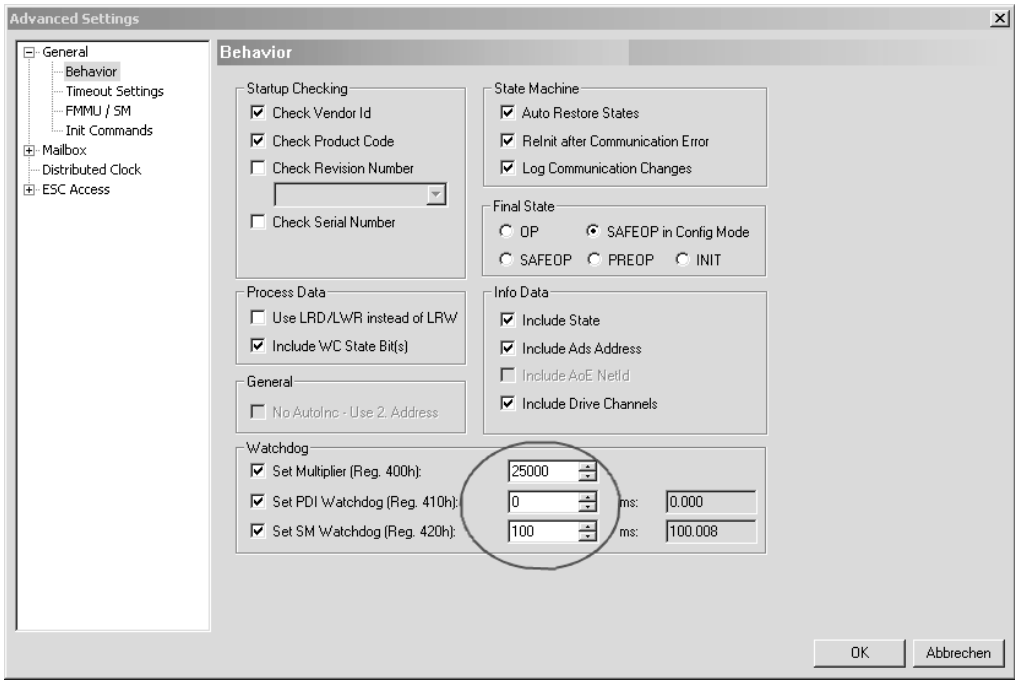
For synchronous operation, select the option "DC for synchronization" on the DC (Distributed Clock) tab page. Make sure that the cycle time in the "Cycle time" field is the same as the synchronization time specified in P888.



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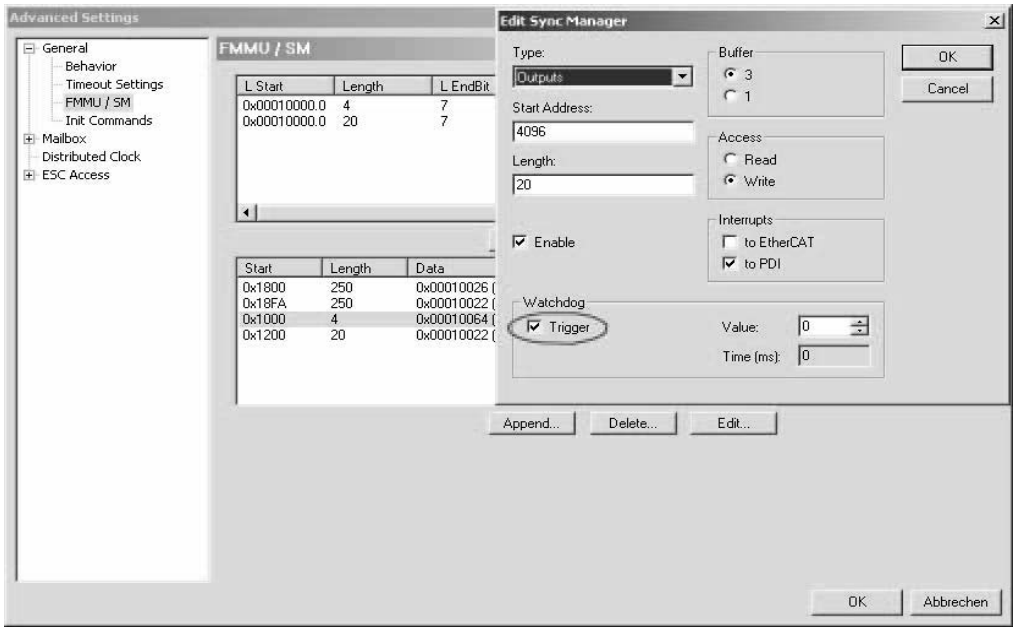
Activate timeout monitoring for Sync Manager 0x1000. To do so, in the "Edit Sync Manager" window activate the "Trigger" checkbox in the "Watchdog" group box (→ following figure).



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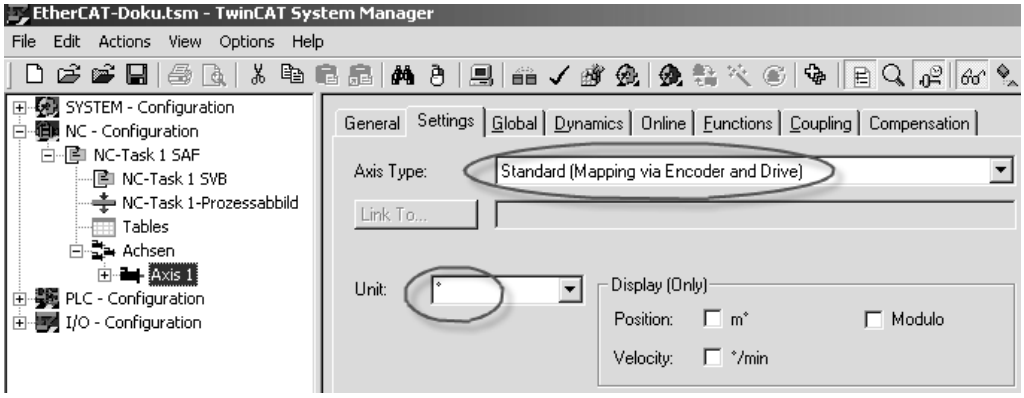
Configuring the NC axis

Next, configure the NC axis (→ following figure).



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On the "Settings" tab page, choose the option "Standard" in the "Axis Type" field and select the system unit (e. g. °) in the "Unit" field.

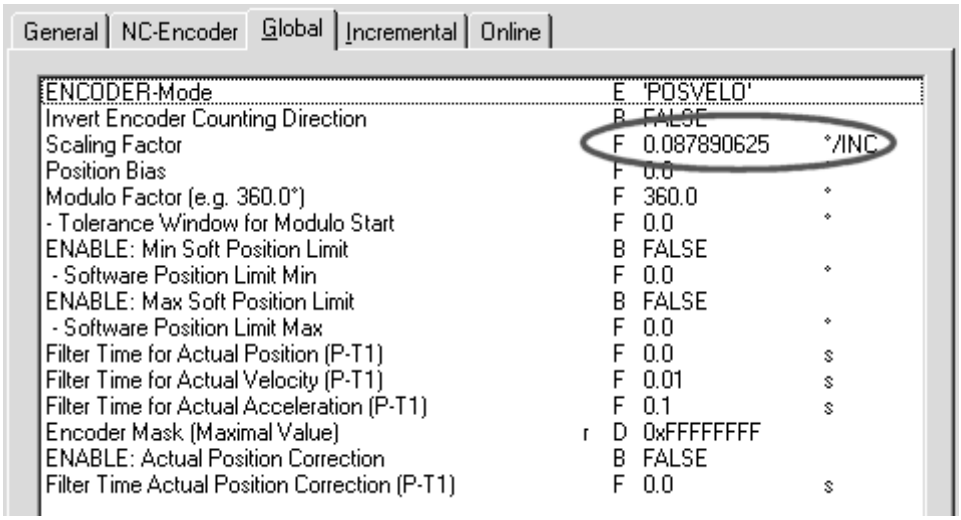
On the "Global" tab page, set the maximum speed and lag error monitoring.

On the "Dynamics" tab page, set the ramp times.

The settings you make must suit the mechanical components and match the settings made in the inverter.

Configuring the encoder

"CANopen DS402" is defined as the encoder (under "Axis x_Enc") and configured as follows (→ following figure).



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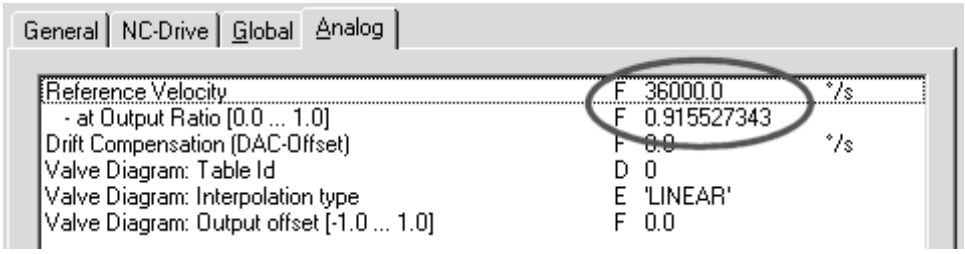
The scaling factor is calculated using the following formula:

360 ° /(4096 inc/revolution) = 0.087890625 °/inc

7.4.1 Velocity mode

"Drive connected to KLXXX..." is selected as the drive (under "Axis x_Drive") in velocity mode. The following values are specified in the "Analog" tab page (→ following figure):



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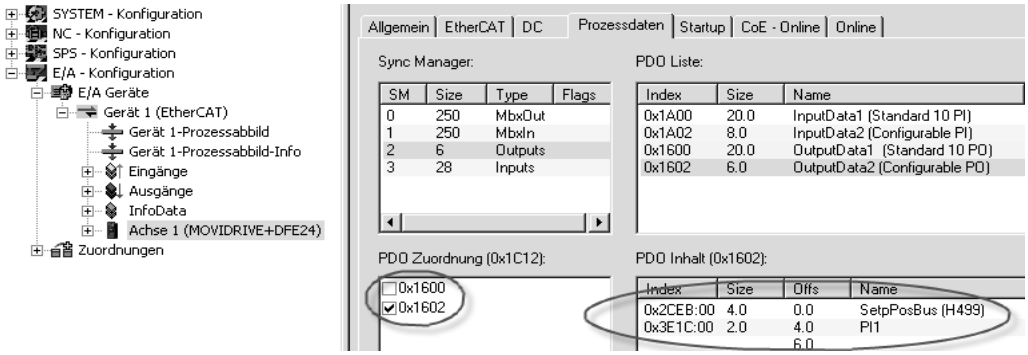
The speed setpoint ("Reference velocity") = maximum motor speed × 6 is entered with the conversion factor "at Output Ratio [0.0 ... 1.0]" = (maximum motor speed × 5) / 2^{15}

In the PDO assignment, PDO1 is deactivated and the setpoint speed and control word or actual position (H511) and status word are defined in PDO2 (→ following figures).



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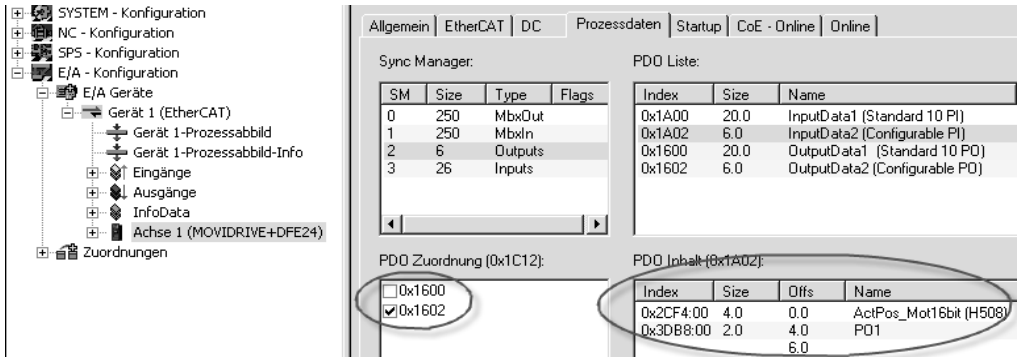

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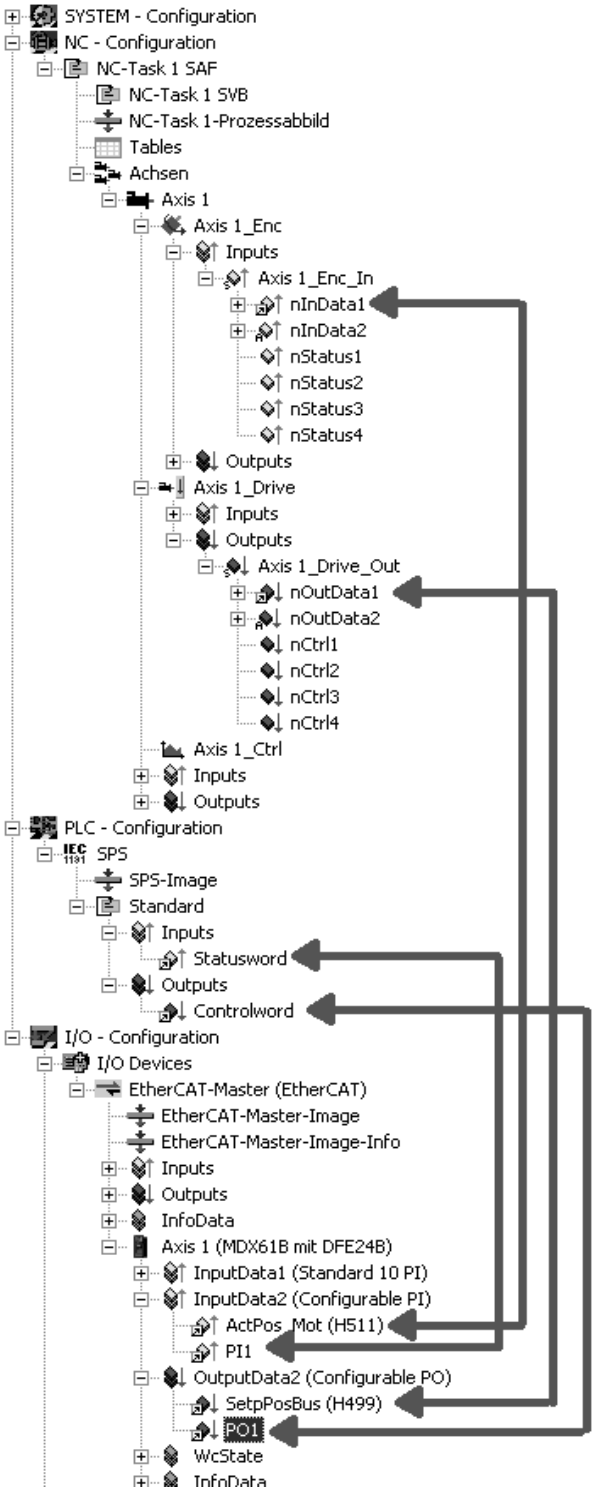
Finally, the drive's setpoint speed and actual position are linked with the NC axis and the control word and status word 1 are controlled with the PLC task in accordance with the description in the fieldbus unit profile (→ following figure).



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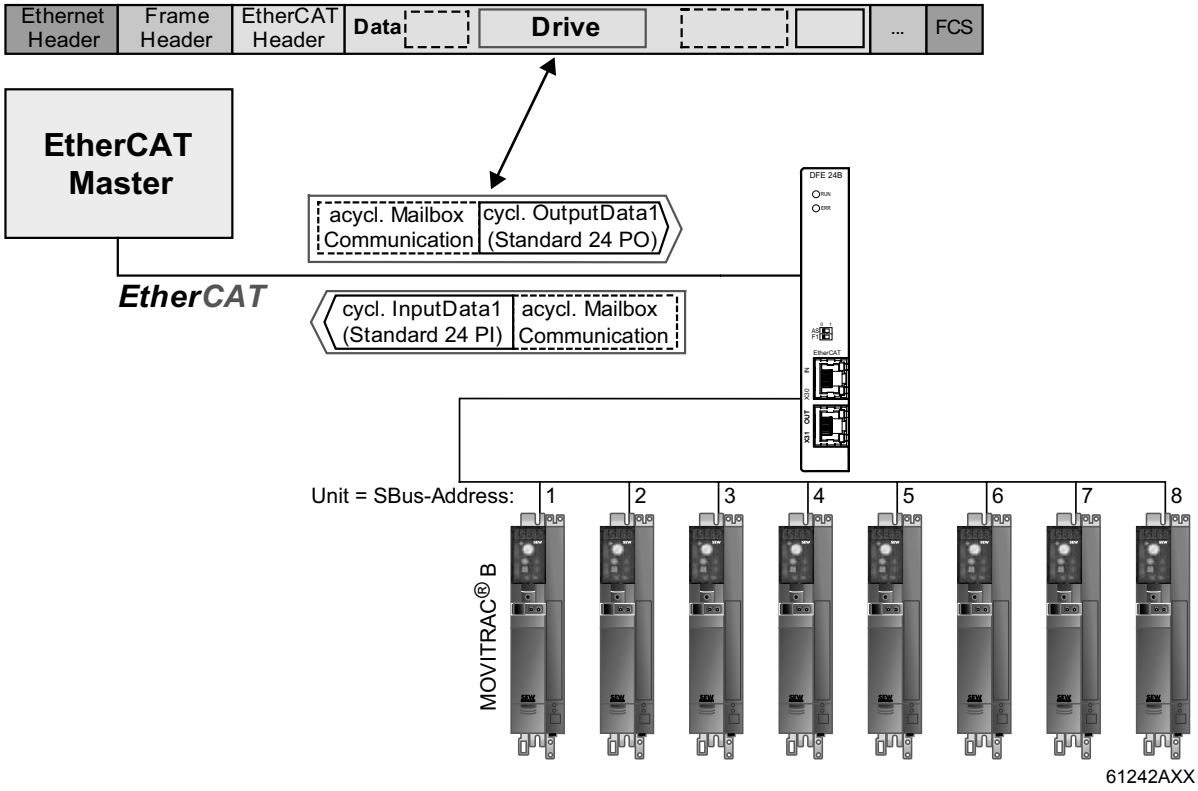
8 Operating MOVITOOLS® MotionStudio via EtherCAT

This section describes how to operate MOVITOOLS® MotionStudio via EtherCAT.

8.1 Introduction

EtherCAT provides the user with acyclical parameter services in addition to cyclical process data. This acyclical data exchange takes place via the mailbox gateway of the EtherCAT master (→ following figure).

The configuration services of MOVITOOLS® MotionStudio are inserted in EtherCAT telegrams via the mailbox gateway in the EtherCAT master. The drives' feedback is transferred in the same way from DFE24B to the mailbox gateway and on to the MOVITOOLS® MotionStudio.

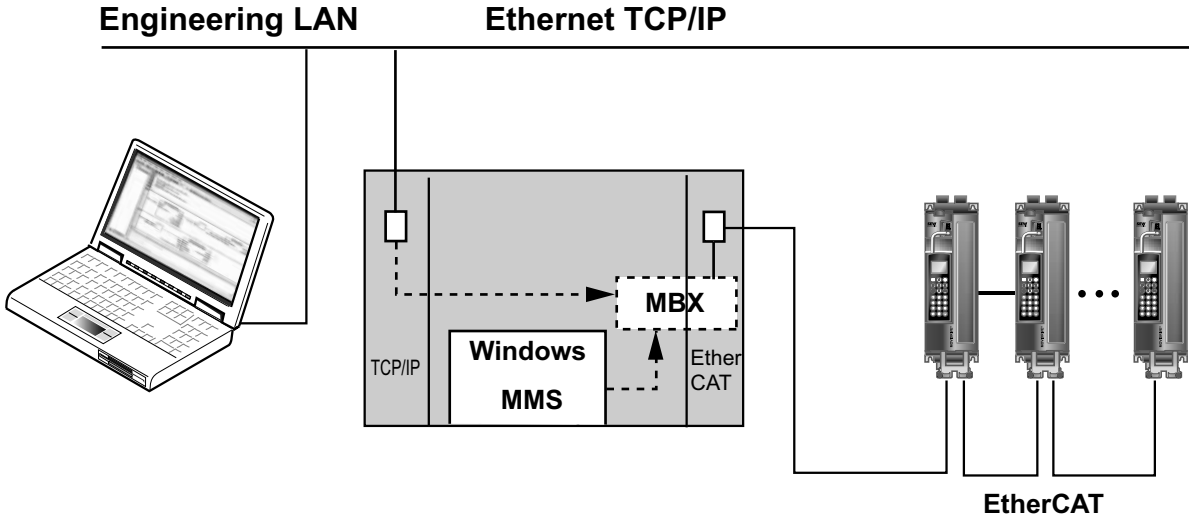


VoE (Vendor-specific over EtherCAT) is activated and the EtherCAT mailbox set up on the EtherCAT master. VoE can then be used to establish a connection with the drive and operate MOVITOOLS® MotionStudio online.

8.2 Required hardware

If an operating system that is compatible with MOVITOOLS® MotionStudio is available on the EtherCAT master, no additional hardware is required.

If a compatible operating system is not installed, or if MOVITOOLS® MotionStudio is to be operated from another PC, the EtherCAT master requires a second Ethernet interface with MOVITOOLS® MotionStudio that is connected to the PC via LAN (→ following figure).



MMS = MOVITOOLS® MotionStudio

MBX = Mailbox gateway

8.3 Required software

MOVITOOLS® MotionStudio from version 5.40

8.4 Installation

Install MOVITOOLS® MotionStudio. If you are using MOVIDRIVE® B, you must also install the MOVITOOLS® package.

8.5 Configuring the mailbox gateway

- Activate VoE/EoE support on the EtherCAT master.
- Specify the IP address of the EtherCAT mailbox gateway. The IP address is usually assigned by the TwinCAT program and may not be changed.

The settings look as follows in Beckhoff's TwinCAT program:

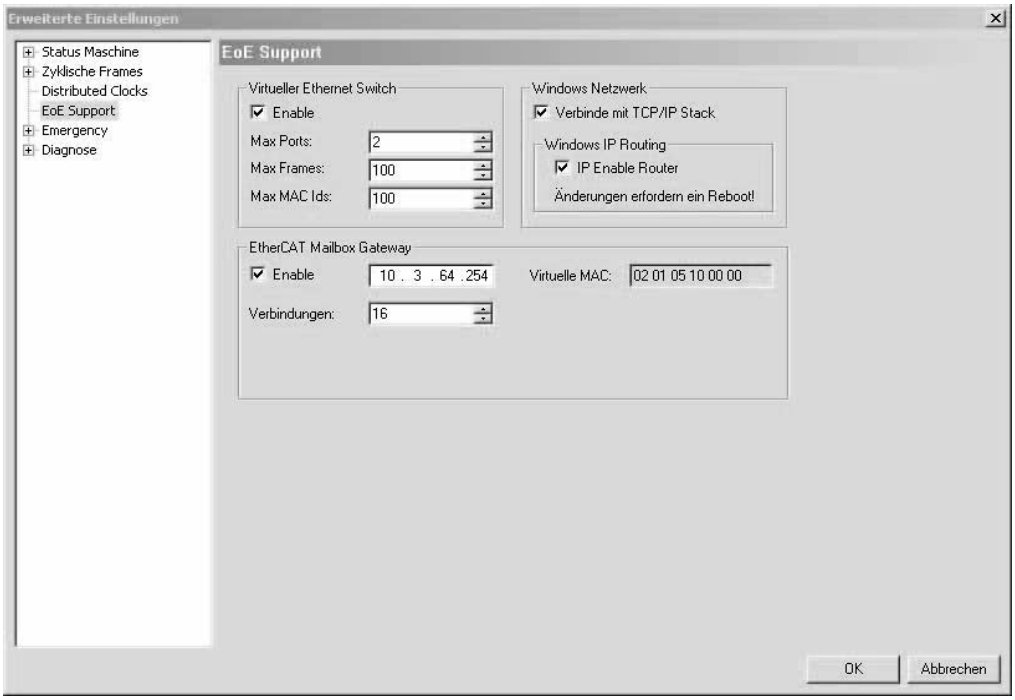


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Figure 19: Set the IP address of the EtherCAT mailbox gateway

8.6 Network settings on the engineering PC

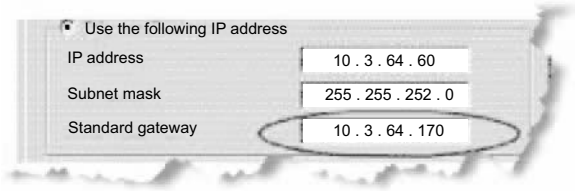
If MOVITOOLS® MotionStudio is running on the EtherCAT master, you do not have to make any additional network settings.

If the EtherCAT master is connected to an Ethernet network, PCs in the same subnet can access SEW drives on EtherCAT with MOVITOOLS® MotionStudio (→ Sec. 8.2). To do so, the telegrams from the engineering PC are routed via the Ethernet interface of the EtherCAT master to the mailbox gateway.

Two variants are available for routing:

1. Variant: Access to the mailbox gateway by specifying the standard gateway on the engineering PC. In this variant, the IP address of the EtherCAT master is entered as the standard gateway for TCP/IP communication.

   Choose [Start] / [Settings] / [Network and DFÜ connections]. The "Network and DFÜ connections" window opens. Make a right mouse click on a LAN connection. From the context menu that opens choose "Properties". The "Properties of LAN connection" window opens. In the selection window, select the "Internet protocol (TCP/IP)" checkbox. Next, click the "Properties" button. The "Properties of Internet protocol (TCP/IP)" window opens. Select the "Use the following IP address" checkbox and make the following entry (→ below figure):



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2. Variant: Access by defining a static route.

   In this variant, an entry is added to the routing table of the engineering PC that routes the engineering data via the EtherCAT master to the mailbox gateway.

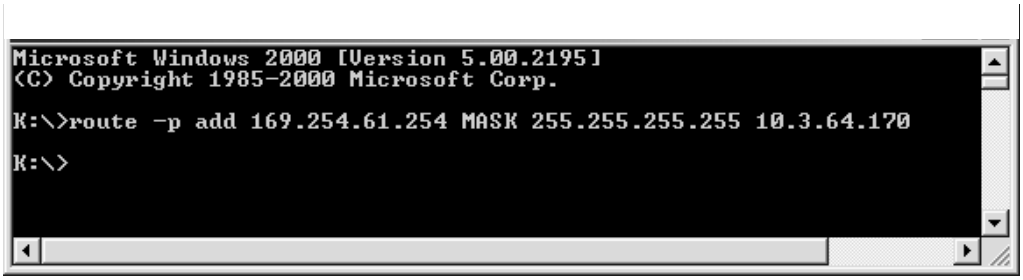
   In the DOS box, the command for creating a static route is as follows:

   route –p add [Target] MASK [Netmask] [Gateway]

   [Target]: Is the IP address of the EtherCAT mailbox gateway

   [Net mask]: Is usually set to 255.255.255.255 (host routing)

   [Gateway]: Matches the IP address of the EtherCAT master in the TCP/IP network



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8.7 Configuring the SEW communication server

To be able to run MOVITOOLS® MotionStudio via EtherCAT, you must first configure the SEW communication server.

8.7.1 Establishing communication

MOVITOOLS® MotionStudio allows you to communicate with electronics products from SEW-EURODRIVE GmbH & Co KG via different communication paths at the same time.

When you start MOVITOOLS® MotionStudio, the SEW communication server is started automatically and an additional symbol will appear in the Windows status bar. .

8.7.2 Procedure

Four steps are involved in configuring communication:

1. Open the settings for the SEW communication server by clicking on the "Communication connection" symbol in the toolbar (→ following figure) or by selecting the "Network communication connections" menu.

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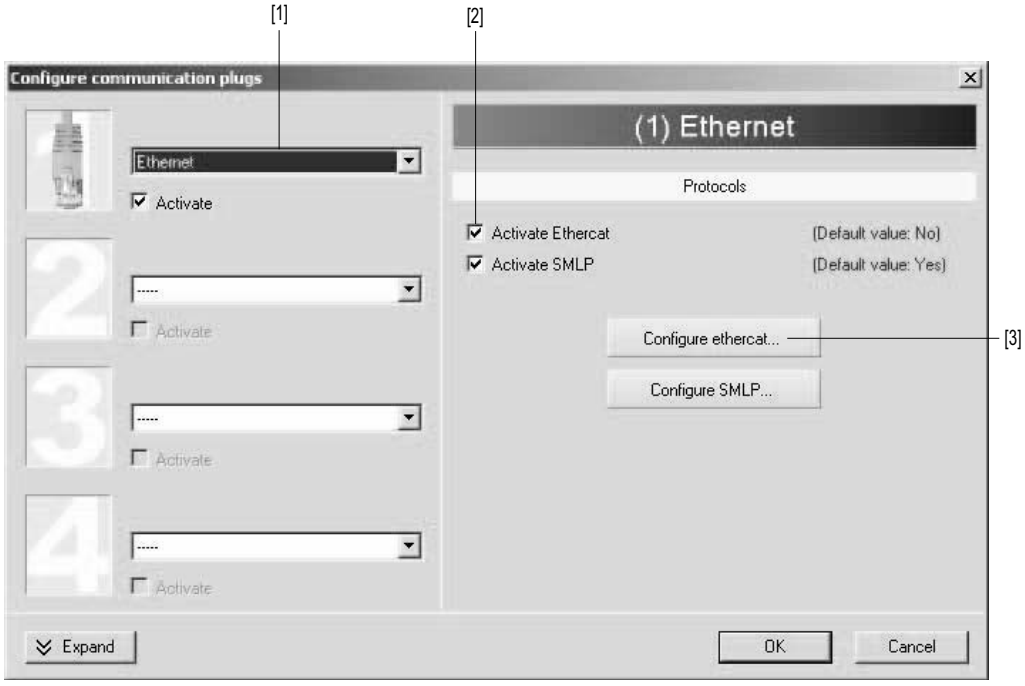
2. Configure an Ethernet interface. To do so, choose the option "Ethernet" from the drop-down list [1]. In the "Protocols" section, select the "Activate EtherCAT" checkbox [2]. Click the button "Setup EtherCAT" [3].



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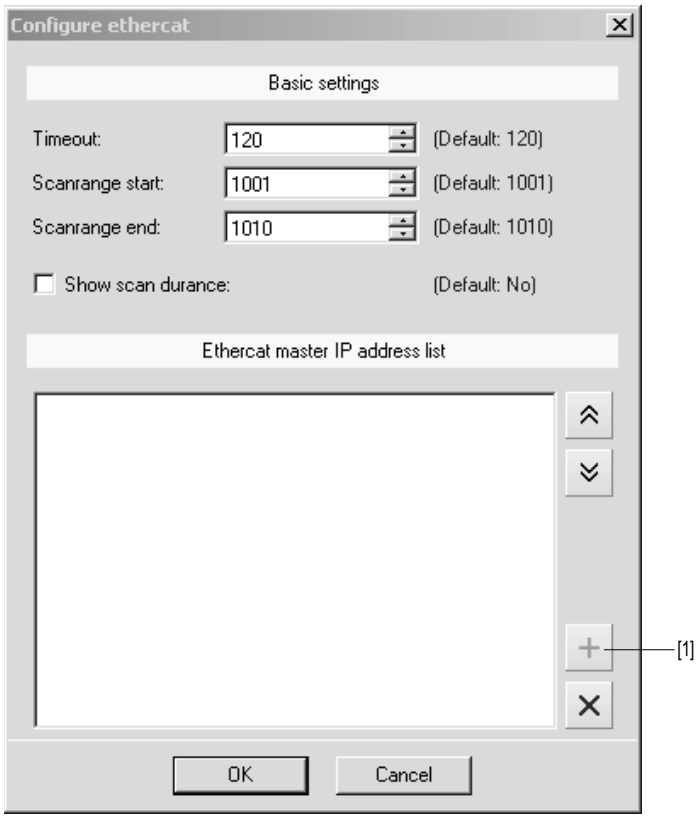
3. The "Set up Ethercat" window opens. Click the "+" button [1] and add the IP address of the mailbox gateway to the EtherCAT master.



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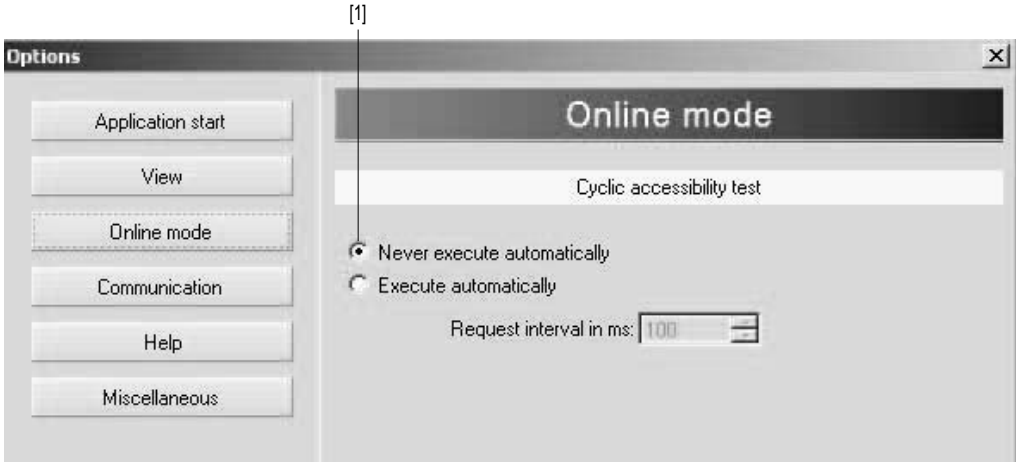
Observe the specified unit scan range in the basic settings (Fields "Scan range from/to"). EtherCAT addresses 1001 to 1010 are scanned as standard. You must adjust this unit scan range accordingly for large EtherCAT networks.

4. In the [Setting] / [Options] menu, select the menu item "Online mods". Check that the option "Do not perform automatically" [1] is selected in the "Cyclic availability test" field.



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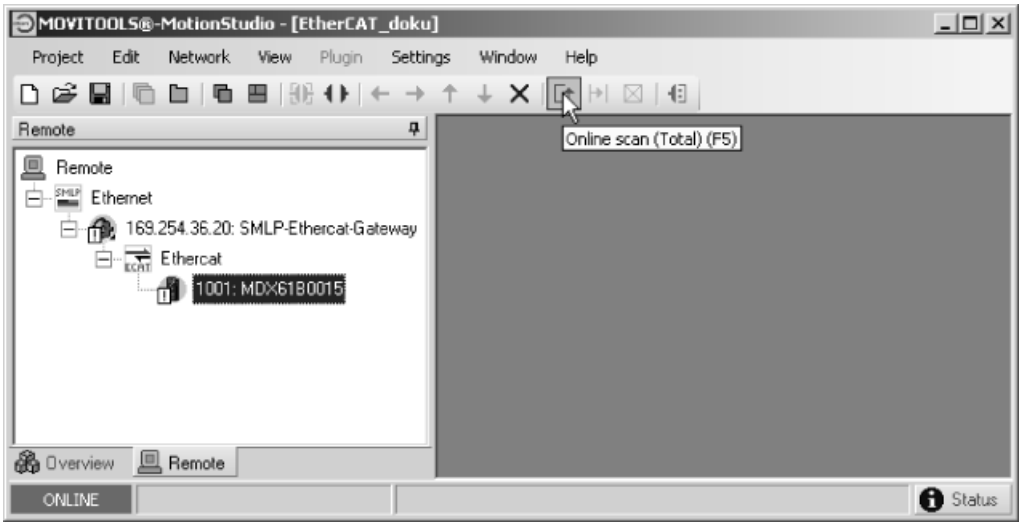
8.8 Automatic search for connected units (unit scan)

Press the <F5> function key or the "Online scan" symbol to perform an automatic search through all communication channels and display the connected units in the unit tree.



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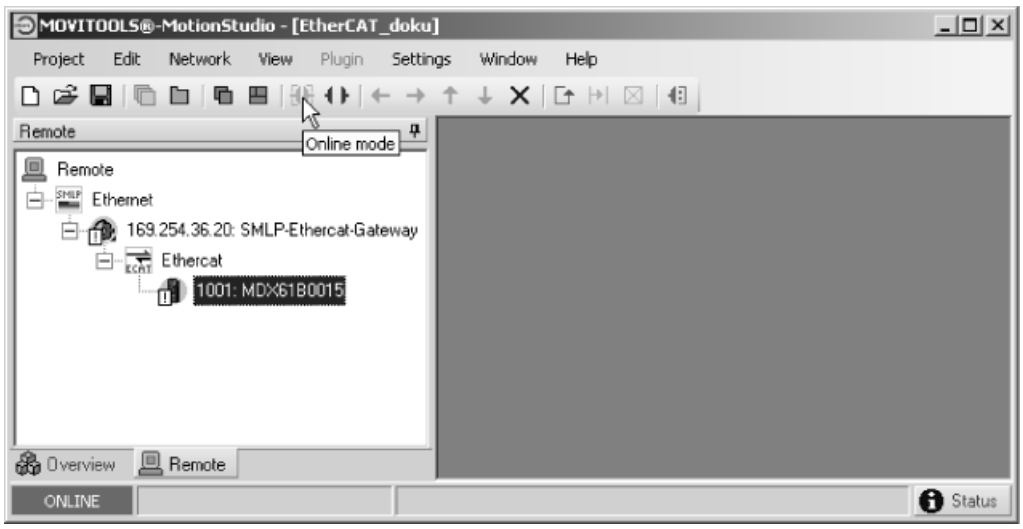
8.9 Activating online mode

- Perform the unit scan (see section 8.7).
- Use the mouse to highlight the required unit. Switch MOVITOOLS® MotionStudio to online mode by pressing the "Online Mode" button (→ following figure).



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- Select the unit you want to operate and activate the plug-in menu with the right mouse button.

8.10 Familiar problems during the operation of MOVITOOLS® MotionStudio

Check the following points if problems occur during configuration:

- Have you activated the EtherCAT protocol in the MOVITOOLS® MotionStudio communication settings?
- Is the correct IP address entered for the mailbox gateway in the EtherCAT master?
- Is it possible to address the EtherCAT mailbox gateway using the "ping" command?
- Is the setting made for the unit scan range sufficient?
- Is the online cyclic accessibility test activated in MOVITOOLS® MotionStudio?

9 Error Diagnostics

9.1 Diagnostic procedures

The diagnostic procedures described in the following section demonstrate the error analysis methods for the following problems:

- Inverter does not operate on EtherCAT.
- Inverter cannot be controlled using the EtherCAT master.

For more information dealing specifically with the inverter parameter settings for various fieldbus applications, refer to the *Fieldbus Unit Profile manual and the MOVIDRIVE® parameter list*.

Step 1: Check the connection between the inverter and EtherCAT

Is the bus connected plugged into the master / inverter?	NO →	**[A]**
YES ↓		
How is the **Link/activity** LED reacting on option DFE24B?	OFF →	**[A]**
ON ↓		
Is the physical connection between the inverter and EtherCAT OK? Make sure EtherCAT is connected correctly at X30 IN (incoming EtherCAT connection) / X31 OUT (outgoing EtherCAT connection).	NO →	**[A]**
YES ↓		
Continue with 2: Response of the RUN LED?		

[A]	Check the bus cabling.

Step 2: Response of the RUN LED?

OFF	Has the master switched the slave to the INIT state?	YES →	**[A]**
		NO →	**[B]**
Flashing orange	Bus in the master has not started.	→	**[C]**
Flashing green	Slave is the the state PRE-OPERATIONAL.	→	**[C]**
Lights up green once	Slave is the the state SAFE-OPERATIONAL.	→	**[C]**
Lights up green	Slave is the the state OPERATIONAL.	→	**[C]**

[A]	Startup the bus in the master.
[B]	Option DFE24B is defective.
[C]	Continue with 3: Response of the ERR LED?

Step 3: Status of the ERR LED?

OFF	**Example 1:** LED RUN lights up green (slave is in the state OPERATIONAL). ↓ EtherCAT communication of the DFE24B option is in the operating state. **Example 2:** • LED RUN flashes green (slave is in the state PRE-OPERATIONAL) • LED RUN lights up green once (slave is in the state SAFE-OPERATIONAL) ↓ Startup the bus in the master and activate the state OPERATIONAL in the slave. ↓ Start process data communication.

Flickering	Prerequisite: • LED RUN flashes green (slave is in the state PRE-OPERATIONAL) • LED RUN lights up green once (slave is in the state SAFE-OPERATIONAL) ↓ A boot error has been detected. Boot option DFE24B. ↓ If the ERR LED continues to flicker, option DFE24B is defective.

Flashes red twice	**Example 1:** LED RUN lights up green (slave is in the state OPERATIONAL). ↓ Fieldbus timeout, activate process output data. **Example 2:** • LED RUN flashes green (slave is in the state PRE-OPERATIONAL) • LED RUN lights up green once (slave is in the state SAFE-OPERATIONAL) ↓ Watchdog timeout → start the bus in the master and activate the state OPERATIONAL in the slave. ↓ Start process data communication.

Lights up red once	Prerequisite: • LED RUN flashes green (slave is in the state PRE-OPERATIONAL) • LED RUN lights up green once (slave is in the state SAFE-OPERATIONAL) ↓ The status has changed automatically. Repair the configuration error and startup the bus in the master again. ↓ Activate OPERATIONAL state in the slave. ↓ Start process data communication.

Flashing	Prerequisite: • LED RUN flashes green (slave is in the state PRE-OPERATIONAL) • LED RUN lights up green once (slave is in the state SAFE-OPERATIONAL)
	↓
	Invalid configuration. Repair the configuration error and start the bus in the master again.
	↓
	Activate OPERATIONAL state in the slave.
	↓
	Start process data communication.

9.2 List of errors

- The following error list applies to option DFE24B in gateway operation.
- When operating option DFE24B in MOVIDRIVE® B, the corresponding error codes can be found in the MOVIDRIVE® MDX60B/61B operating instructions.

Error code	Designation	Response	Cause	Measure
17	Stack overflow	SBus communication is stopped	Malfunction of inverter electronics, possibly due to EMC influence	Check ground connections and shielding and correct, if necessary. Contact SEW service if this error occurs again.
18	Stack underflow	SBus communication is stopped		
19	NMI	SBus communication is stopped		
20	Undefined Opcode	SBus communication is stopped		
21	Protection fault	SBus communication is stopped		
22	Illegal word operand access	SBus communication is stopped		
23	Illegal instruction access	SBus communication is stopped		
25	Eeprom	SBus communication is stopped	Error while accessing EEPROM	Activate factory settings, perform reset and reconfigure DFE. Contact SEW service if the error occurs again.
28	Fieldbus timeout	Default: PO data = 0 Error response adjustable via P831	No communication between master and slave within the projected response monitoring.	• Check communication routine of the master • Extend the fieldbus timeout interval (response monitoring) in the master configuration or deactivate monitoring
37	Watchdog error	SBus communication is stopped	Error during execution of system software	Contact SEW Service.
45	Initialization error	SBus communication is stopped	Error after self-test during reset	Perform a reset. Consult SEW Service if the error occurs again.
111	Device Timeout system error	No	Check the red system error LED LED (**H1**) of DFx If this LED lights up red or flashes, one or more stations on the SBus were not addressed within the timeout time. If the red system error LED (**H1**) is flashing, the error is in the DFx itself. In this case, error F111 was only reported to the controller via fieldbus.	Check voltage supply, SBus cabling and SBus terminating resistors. Switch DFx off and on again. If the error is still present, query the error via diagnostic interface and perform the action described in this table.

10 Technical Data

10.1 Option DFE24B for MOVIDRIVE® MDX61B

Option DFE24B (MOVIDRIVE® MDX61B)	
Part number	1821 126 7
Power consumption	P = 3 W
Standards	IEC 61158, IEC 61784-2
Baud rate	100 MBaud full duplex
Connection technology	2 × RJ45 (8x8 modularJack)
Bus termination	Not integrated because bus termination is activated automatically.
OSI layer	EtherNet II
Station address	Set via the EtherCAT master (→ display using P093)
Name of the XML file	SEW_DFE24B.xml
Vendor ID	0x59 (CANopenVendor ID)
EtherCAT services	• CoE (CANopen over EtherCAT) • VoE (Simple MOVILINK-Protocol over EtherCAT)
Firmware status MOVIDRIVE® B	824 854 0.18 or above (→ display using P076)
Tools for startup	• PC program MOVITOOLS® MotionStudio from version 5.40 • DBG60B keypad

10.2 Option DFE24B for MOVITRAC® B and Universal Gateway Housing UOH11B

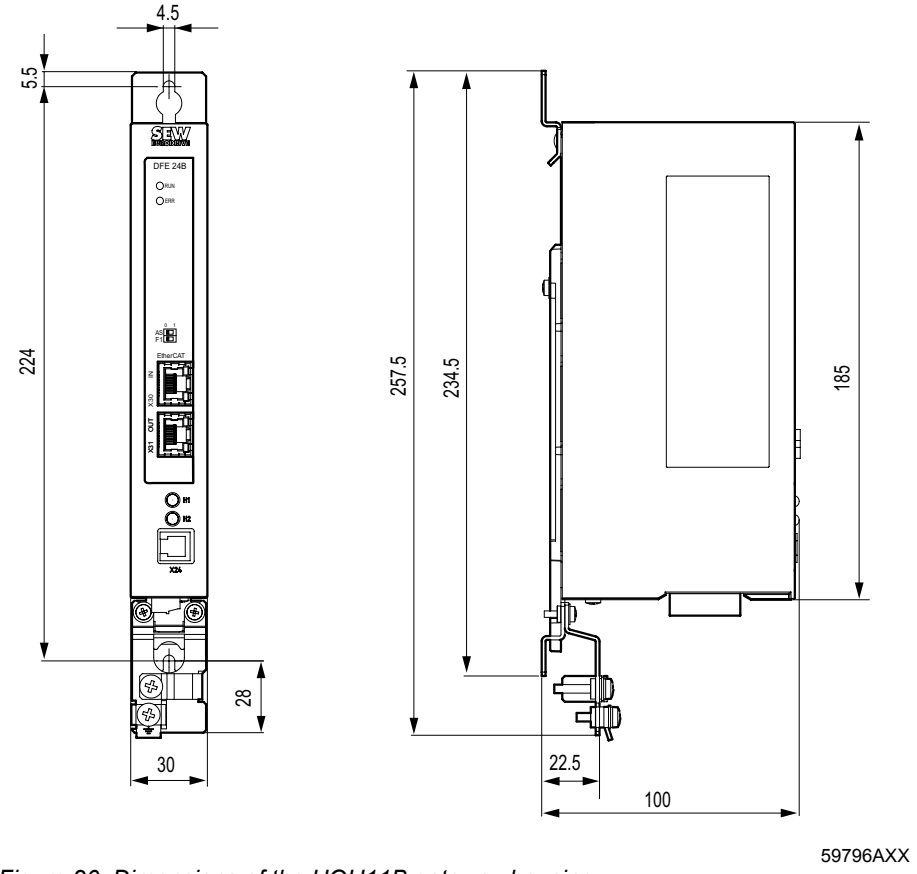

Figure 20: Dimensions of the UOH11B gateway housing

Option DFE24B (MOVITRAC® B gateway)	
External voltage supply	U = DC 24 V (–15 %, +20 %) I_{max} = DC 200 mA P_{max} = 3.4 W
Standards	IEC 61158, IEC 61784-2
Baud rate	100 MBaud full duplex
Connection technology	2 × RJ45 (8x8 modularJack)
Bus termination	Not integrated because bus termination is activated automatically.
OSI layer	EtherNet II
Station address	Set via the EtherCAT master (→ display using P093)
Name of the XML file	SEW_DFE24B.xml
Vendor ID	0x59 (CANopenVendor ID)
EtherCAT services	• CoE (CANopen over EtherCAT) • VoE (Simple MOVILINK-Protocol over EtherCAT)
Firmware status MOVIDRIVE® B	No special firmware is required
Tools for startup	• PC program MOVITOOLS® MotionStudio from version 5.40 • FBG60B keypad

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Address List

Germany			
Headquarters **Production** **Sales**	**Bruchsal**	SEW-EURODRIVE GmbH & Co KG Ernst-Blickle-Straße 42 D-76646 Bruchsal P.O. Box Postfach 3023 • D-76642 Bruchsal	Tel. +49 7251 75-0 Fax +49 7251 75-1970 http://www.sew-eurodrive.de sew@sew-eurodrive.de
Service **Competence Center**	**Central**	SEW-EURODRIVE GmbH & Co KG Ernst-Blickle-Straße 1 D-76676 Graben-Neudorf	Tel. +49 7251 75-1710 Fax +49 7251 75-1711 sc-mitte@sew-eurodrive.de
	North	SEW-EURODRIVE GmbH & Co KG Alte Ricklinger Straße 40-42 D-30823 Garbsen (near Hannover)	Tel. +49 5137 8798-30 Fax +49 5137 8798-55 sc-nord@sew-eurodrive.de
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	Drive Service Hotline / 24 Hour Service		+49 180 5 SEWHELP +49 180 5 7394357
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France			
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Assembly **Sales** **Service**	**Bordeaux**	SEW-USOCOME Parc d'activités de Magellan 62, avenue de Magellan - B. P. 182 F-33607 Pessac Cedex	Tel. +33 5 57 26 39 00 Fax +33 5 57 26 39 09
	Lyon	SEW-USOCOME Parc d'Affaires Roosevelt Rue Jacques Tati F-69120 Vaulx en Velin	Tel. +33 4 72 15 37 00 Fax +33 4 72 15 37 15
	Paris	SEW-USOCOME Zone industrielle 2, rue Denis Papin F-77390 Verneuil l'Etang	Tel. +33 1 64 42 40 80 Fax +33 1 64 42 40 88
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	Sydney	SEW-EURODRIVE PTY. LTD. 9, Sleigh Place, Wetherill Park New South Wales, 2164	Tel. +61 2 9725-9900 Fax +61 2 9725-9905 enquires@sew-eurodrive.com.au
	Townsville	SEW-EURODRIVE PTY. LTD. 12 Leyland Street Garbutt, QLD 4814	Tel. +61 7 4779 4333 Fax +61 7 4779 5333 enquires@sew-eurodrive.com.au

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	Vancouver	SEW-EURODRIVE CO. OF CANADA LTD. 7188 Honeyman Street Delta. B.C. V4G 1 E2	Tel. +1 604 946-5535 Fax +1 604 946-2513 b.wake@sew-eurodrive.ca
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Morocco			
Sales	**Casablanca**	Afit 5, rue Emir Abdelkader MA 20300 Casablanca	Tel. +212 22618372 Fax +212 22618351 richard.miekisiak@premium.net.ma

Netherlands			
Assembly **Sales** **Service**	**Rotterdam**	VECTOR Aandrijftechniek B.V. Industrieweg 175 NL-3044 AS Rotterdam Postbus 10085 NL-3004 AB Rotterdam	Tel. +31 10 4463-700 Fax +31 10 4155-552 http://www.vector.nu info@vector.nu

New Zealand			
Assembly **Sales** **Service**	**Auckland**	SEW-EURODRIVE NEW ZEALAND LTD. P.O. Box 58-428 82 Greenmount drive East Tamaki Auckland	Tel. +64 9 2745627 Fax +64 9 2740165 http://www.sew-eurodrive.co.nz sales@sew-eurodrive.co.nz
	Christchurch	SEW-EURODRIVE NEW ZEALAND LTD. 10 Settlers Crescent, Ferrymead Christchurch	Tel. +64 3 384-6251 Fax +64 3 384-6455 sales@sew-eurodrive.co.nz

Norway			
Assembly **Sales** **Service**	**Moss**	SEW-EURODRIVE A/S Solgaard skog 71 N-1599 Moss	Tel. +47 69 241-020 Fax +47 69 241-040 http://www.sew-eurodrive.no sew@sew-eurodrive.no

Peru			
Assembly **Sales** **Service**	**Lima**	SEW DEL PERU MOTORES REDUCTORES S.A.C. Los Calderos, 120-124 Urbanizacion Industrial Vulcano, ATE, Lima	Tel. +51 1 3495280 Fax +51 1 3493002 http://www.sew-eurodrive.com.pe sewperu@sew-eurodrive.com.pe

Poland			
Assembly **Sales** **Service**	**Lodz**	SEW-EURODRIVE Polska Sp.z.o.o. ul. Techniczna 5 PL-92-518 Łódź	Tel. +48 42 67710-90 Fax +48 42 67710-99 http://www.sew-eurodrive.pl sew@sew-eurodrive.pl

Portugal			
Assembly **Sales** **Service**	**Coimbra**	SEW-EURODRIVE, LDA. Apartado 15 P-3050-901 Mealhada	Tel. +351 231 20 9670 Fax +351 231 20 3685 http://www.sew-eurodrive.pt infosew@sew-eurodrive.pt

Romania			
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Russia			
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	Banská Bystrica	SEW-Eurodrive SK s.r.o. Rudlovská cesta 85 SK-97411 Banská Bystrica	Tel. +421 48 414 6564 Fax +421 48 414 6566 sew@sew-eurodrive.sk

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South Africa			
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	Durban	SEW-EURODRIVE (PROPRIETARY) LIMITED 2 Monaceo Place Pinetown Durban P.O. Box 10433, Ashwood 3605	Tel. +27 31 700-3451 Fax +27 31 700-3847 dtait@sew.co.za

Spain			
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Sweden			
Assembly **Sales** **Service**	**Jönköping**	SEW-EURODRIVE AB Gnejsvägen 6-8 S-55303 Jönköping Box 3100 S-55003 Jönköping	Tel. +46 36 3442-00 Fax +46 36 3442-80 http://www.sew-eurodrive.se info@sew-eurodrive.se

Switzerland			
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Thailand			
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Tunisia			
Sales	**Tunis**	T. M.S. Technic Marketing Service 5, Rue El Houdaibiah 1000 Tunis	Tel. +216 71 4340-64 + 71 4320-29 Fax +216 71 4329-76 tms@tms.com.tn

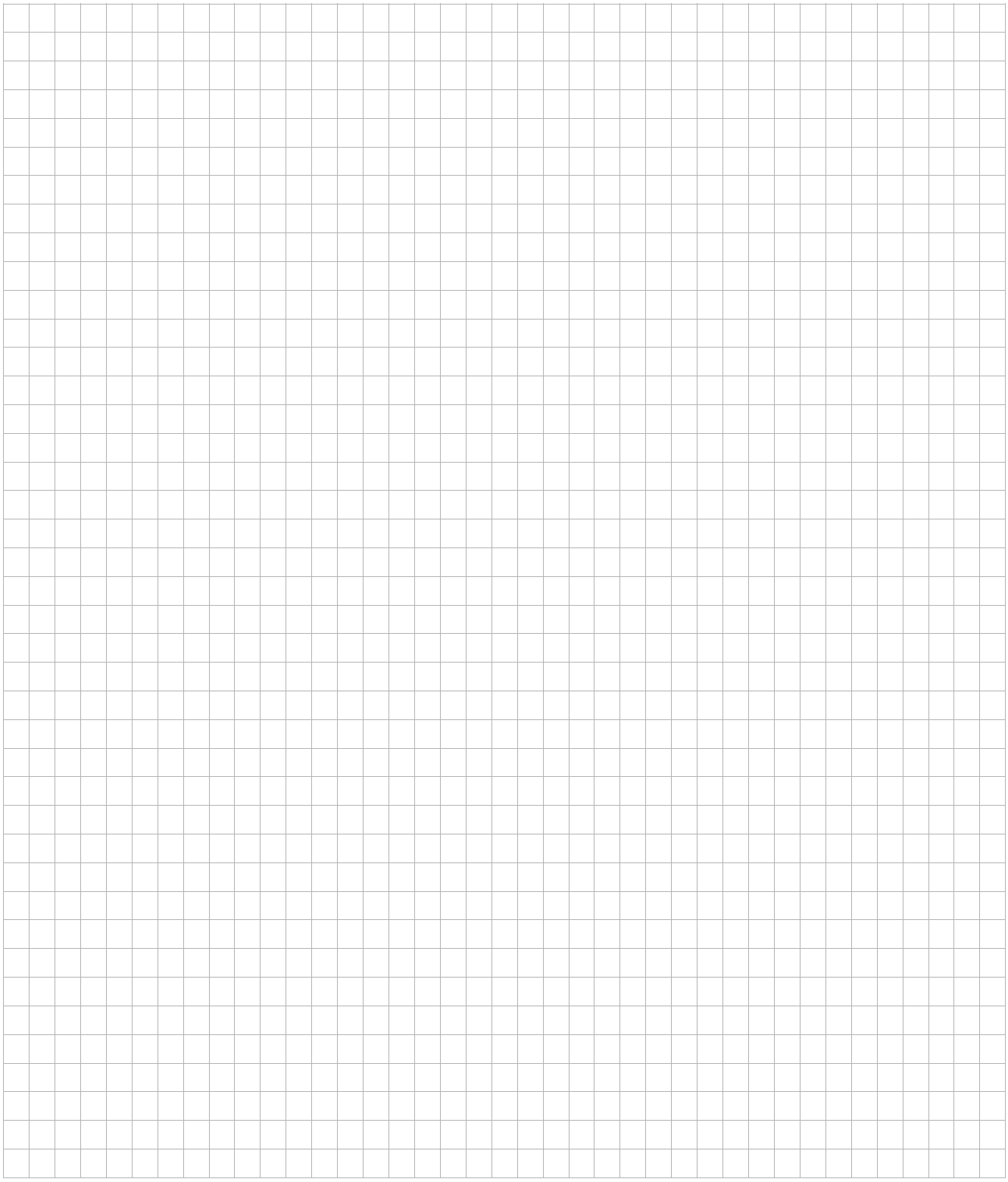
Turkey			
Assembly **Sales** **Service**	**Istanbul**	SEW-EURODRIVE Hareket Sistemleri San. ve Tic. Ltd. Sti. Bagdat Cad. Koruma Cikmazi No. 3 TR-34846 Maltepe ISTANBUL	Tel. +90 216 4419163 / 164 3838014/15 Fax +90 216 3055867 http://www.sew-eurodrive.com.tr sew@sew-eurodrive.com.tr

Ukraine			
Sales **Service**	**Dnepropetrovsk**	SEW-EURODRIVE Str. Rabochaja 23-B, Office 409 49008 Dnepropetrovsk	Tel. +380 56 370 3211 Fax +380 56 372 2078 http://www.sew-eurodrive.ua sew@sew-eurodrive.ua
Sales	**Kiev**	SEW-EURODRIVE GmbH S. Oleynika str. 21 02068 Kiev	Tel. +380 44 503 95 77 Fax +380 44 503 95 78 kso@sew-eurodrive.ua

USA			
Production **Assembly** **Sales** **Service**	**Greenville**	SEW-EURODRIVE INC. 1295 Old Spartanburg Highway P.O. Box 518 Lyman, S.C. 29365	Tel. +1 864 439-7537 Fax Sales +1 864 439-7830 Fax Manuf. +1 864 439-9948 Fax Ass. +1 864 439-0566 Telex 805 550 http://www.seweurodrive.com cslyman@seweurodrive.com

USA			
Assembly **Sales** **Service**	**San Francisco**	SEW-EURODRIVE INC. 30599 San Antonio St. Hayward, California 94544-7101	Tel. +1 510 487-3560 Fax +1 510 487-6381 cshayward@seweurodrive.com
	Philadelphia/PA	SEW-EURODRIVE INC. Pureland Ind. Complex 2107 High Hill Road, P.O. Box 481 Bridgeport, New Jersey 08014	Tel. +1 856 467-2277 Fax +1 856 845-3179 csbridgeport@seweurodrive.com
	Dayton	SEW-EURODRIVE INC. 2001 West Main Street Troy, Ohio 45373	Tel. +1 937 335-0036 Fax +1 937 440-3799 cstroy@seweurodrive.com
	Dallas	SEW-EURODRIVE INC. 3950 Platinum Way Dallas, Texas 75237	Tel. +1 214 330-4824 Fax +1 214 330-4724 csdallas@seweurodrive.com
	Additional addresses for service in the USA provided on request!		

Venezuela			
Assembly **Sales** **Service**	**Valencia**	SEW-EURODRIVE Venezuela S.A. Av. Norte Sur No. 3, Galpon 84-319 Zona Industrial Municipal Norte Valencia, Estado Carabobo	Tel. +58 241 832-9804 Fax +58 241 838-6275 http://www.sew-eurodrive.com.ve sewventas@cantv.net sewfinanzas@cantv.net



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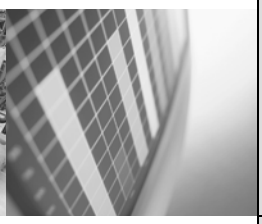



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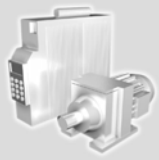
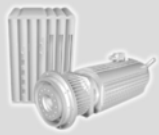
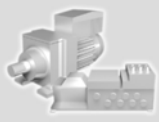
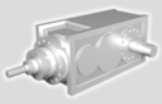

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